U. S. DEPARTMENT OF AGRICULTURE

BUREAU OF SOILS

IN COOPERATION WITH THE
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

SOIL SURVEY OF GIBSON COUNTY INDIANA

BY

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PART II. THE MANAGEMENT OF GIBSON COUNTY SOILS

BY

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[Advance Sheets—Field Operations of the Bureau of Soils, 1922]

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[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

PREFACE

This report consists of two parts. Part I is designed to be descriptive and in a measure technical in the discussion of the soils. Part II is intended to furnish information to county agents, farmers, and others more directly interested in the use of the soil. The soil map serves both parts of the report.

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SOIL SURVEY OF GIBSON COUNTY, IND.

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DESCRIPTION OF THE AREA

Gibson County, Ind., is one of the three counties lying in the "pocket" or fork of the Ohio and Wabash Rivers. Its boundary on the west coincides with the Indiana-Illinois State line in the Wabash River, and the meanders of the White River form a part of the northern boundary, but the remainder of the county lines consist of straight lines, separating it from Pike and Warrick Counties on the east and from Warrick, Vanderburg, and Posey Counties on the south. The area is a very irregular triangle in shape, measuring about 36 miles east and west by 24 miles north and south. It contains 495 square miles, or 316,800 acres.

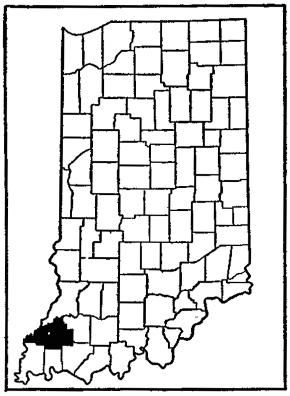

FIG. 34.—Sketch map showing location of the Gibson County area, Indiana.

The southern limit of glaciation in Indiana, which passes near Francisco and Haubstadt, marks the boundary between two great physiographic provinces of the United States. The eastern part of the county belongs to the "Aggraded Valley Section of the Interior Low Plateaus Province," whereas the western portion lies in the "Till Plains Section of the Central Lowland Province."[1]

From the State viewpoint the physiography of Gibson County is wholly that of the "Wabash Lowland Region," which includes both glaciated and driftless uplands with comparatively smooth topography and an average elevation of 500 feet above sea level. There is a comparatively large area occupied by filled-in valleys, even small streams having bottoms of more than normal width.[2]

In detail the physiographic features of Gibson County may be grouped under uplands, terraces, and first bottoms. In general, the uplands are smoothly rolling, but are somewhat rougher in the unglaciated part where several peaks, such as Kennedy and Wilson Hills, rise by steep slopes above the general level. There are also rough, dissected river bluffs north of Princeton and Owensville. A dune topography is developed in several sections near the bottoms, as in the vicinity of Johnson. In the glaciated part of the county there are a number of areas, elevated above first bottoms, which have the appearance of glacial-lake beds or outwash plains. These may be second bottoms of streams. About 100 square miles in the western

[1] Handbook of Indiana Geology, pp. 69 and 70.
[2] Handbook of Indiana Geology, pp. 66, 102.

part of Gibson County are included in the Wabash bottoms. More than half of this bottom land is very smooth and flat, with a slightly higher outer rim from which it slopes very gently back toward the upland. Between the outer rim and the present channel of the Wabash River is slightly lower bottom land, with a ridgy, irregular surface cut by many old stream channels. A very striking feature of this section is the occurrence of "island monadnocks," such as the Gordon Hills, which are areas of upland entirely surrounded by the bottoms.

On the smoothest main divides of the uplands there are few depressions or flats. The slopes at the headwaters of small streams are usually gentle, becoming steeper and rougher near the larger creeks. This condition is sometimes reversed, as in the vicinity of Kennedy Hill and also along many small streams in the Wabash and White River bluffs. Many streams lie in broad, shallow valleys, and others have cut sharp V-shaped gullies. Usually uplands blend into bottoms through broad, gentle slopes, but locally some streams have undercut the hills and produced very steep bluffs, as at the Princeton pumping plant and Skelton Cliff. The topography of the lake plains is generally level and their elevations are lower than the inclosing hills. The lake plains include lower swales which feed the distinct drainage ways and also irregular elevations which rise a few inches or feet above the flats. Other variations noted in the wide Wabash bottoms are the deltas or blended alluvial-fan deposits of tributary streams, which have built up higher, sloping lands near the hills where normally low depressed areas occur.

The highest elevation in Gibson County is probably at Balls Hill, 2 miles north of Princeton, which is 645 feet above sea level. Here, too, is the greatest local relief, since the elevation at the Patoka River channel, a short distance away, is only 400 feet. The average elevation of the county is about 470 feet, and the minimum is 355 feet above sea level. The lake plains lie at an elevation of about 440 feet, and the altitude of the Wabash bottoms averages less than 400 feet.

The natural surface drainage of Gibson County uplands is good. A fairly well-developed network of small streams effectively removes excess rainfall and offsets the rather sluggish underdrainage which prevails, except in the sandier lands near the river bluffs. The lake plains are generally poorly drained and in early days were known as marshes. Parts are under water much of the time, and the higher spots have poor surface drainage and underdrainage. The bottoms present similar conditions, except for the better-drained natural levees immediately along the streams and some areas underlain by porous sands and gravels.

All of the drainage waters reach the Ohio River either directly through Pigeon Creek, which drains the southeastern part, or through the White and Patoka Rivers and other streams which empty into the Wabash River. These are usually sluggish, meandering streams with broad, filled-in valleys ranging up to a mile or more in width, the Wabash bottoms attaining a width of over 8 miles. Upland drainage has been improved by tile and open drains, and many small streams have been dredged and straightened to enable them to carry off the rainfall much more rapidly than formerly. Creeks which once left their channels in the lowest flats of

the Wabash bottoms now flow in straight, dredged ditches. Although the ditching operations have tended to carry off rainfall rapidly and to prevent flooding of the smaller bottoms, the extensive drainage systems of the State pour their waters into the rivers so quickly that the lower Wabash bottoms now have more frequent and destructive floods than formerly, and also periods of very low water. In normal stages the Wabash channel varies from 200 to 900 feet in width and from 3 to 25 feet in depth. It flows in wide curves, and shifts its bed by undercutting the banks at the outside bends, and by building up sand bars and willow flats at the inside bends. Near the channel the land is sometimes badly washed when the stream floods its banks, but widespread damage is prevented by the weeds and trees. The lower bottoms are often flooded by quiet backwater. The land on the Illinois side has been leveed and this tends to increase flooding in Gibson County. A levee and drainage project has been proposed to protect the bottoms of this section.

Gibson County was organized in 1813 from a part of Knox County, and was named for Gen. John Gibson. The pioneers drifted in from Eastern and Southern States, usually along the water routes. By 1820 the population numbered about 3,800, and in 1850, had reached over 10,000, partly because of the development owing to the Wabash and Erie Canal. In 1880 the urban population was 2,566 and the rural was 20,176. The total increased to a maximum of 30,137 in 1910, but the decrease of rural population, which had begun before 1900, resulted in a net loss of 936 in 1920, though the urban population had increased to 7,132. The population is largely of native-born whites.

The rural population comprises 75.6 per cent of the whole, and has an average density of 45.4 persons per square mile. Near towns and on the belt of sandy lands bordering the bottoms, the density is greater. The lower parts of the Wabash Valley have few inhabitants, because of overflows. Many negroes work "bottom" farms.

Princeton was established as the county seat in 1814, and is now the only city in the county, with a population of 7,132. It is the site of the shops of the Southern Railway. Oakland City, population 2,270, is the home of a college of the same name. Fort Branch with 1,339 inhabitants, Owensville with 1,239, Patoka with 637, Francisco with 614, Hazelton with 605, and Haubstadt with 550, are the more important small towns of the county.

The first arteries of transportation were the Wabash, White, and Patoka Rivers, which were supplemented by the Wabash and Erie Canal in the forties, and soon thereafter by the railroads. The streams are no longer suitable for the operation of steamboats, because of great variations in flow.

The Chicago & Eastern Illinois Railroad, connecting Terre Haute and Evansville, passes north and south through Hazelton, Patoka, Princeton, Fort Branch, and Haubstadt. A branch leads from Fort Branch to Owensville and New Harmony, Posey County. A line of the Southern Railway between Louisville and St. Louis serves Oakland City, Francisco, and Princeton. A branch of the Cleveland, Cincinnati, Chicago & St. Louis Railway between Evansville and Mount Carmel, Ill., passes through Johnson and Skelton. The Evansville, Indianapolis & Terre Haute Railway passes through Buckskin, Somerville, and Oakland City.

Gibson County has many miles of hard-surfaced roads, including the Dixie Bee Line, the Atlantic and Pacific Highway, and other automobile routes. The earth roads are in fair shape, except in parts of the overflowed bottoms. In wet falls it is difficult to haul the corn crop from the Wabash Valley lands.

Rural telephone lines reach most parts of the county.

The various towns are local markets for the crops and livestock which are shipped to large cities. Johnson, Patoka, Owensville, and Princeton are important shipping points for the melon crops. Tomatoes are sold to the canning factory at Princeton.

CLIMATE

The general climatic conditions are mentioned in the soils chapter, and the relations of climate to soil development are there indicated.

The accompanying sketch map of Indiana (fig. 35), which is based on data taken from the Purdue Handbook of Agricultural Facts, shows the position of Gibson County in relation to some of the climatic conditions which are of agricultural significance. This map shows that the county has an advantageous position as regards length of growing season and rainfall.

The following table, compiled from records of the Weather Bureau station at Princeton, gives the essential facts for the climate in greater detail than the map. The figures represent very well the conditions in the county as a whole, except for minor variations due to local topographic differences.

Normal monthly, seasonal, and annual temperature and precipitation at Princeton

(Elevation, 481 feet)

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1887)	Total amount for the wettest year (1905)	Snow, average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	35.1	71	−12	3.14	5.10	3.15	4.9
January	31.4	72	−18	3.55	1.00	2.50	8.5
February	32.6	76	−20	3.34	3.40	3.50	7.2
Winter	33.0	76	−20	10.03	9.50	9.15	20.6
March	43.9	88	2	4.26	1.70	2.84	5.5
April	54.8	91	20	3.13	2.30	3.62	.5
May	64.9	100	28	3.60	6.10	4.10	.0
Spring	54.5	100	2	10.99	10.10	10.56	6.0
June	74.2	105	39	3.98	.10	5.35	.0
July	77.4	111	48	3.30	1.00	9.68	.0
August	75.5	106	43	3.30	.25	12.85	.0
Summer	75.7	111	39	10.58	1.35	27.88	.0
September	69.2	105	27	3.33	2.10	2.00	.0
October	56.4	94	21	2.56	1.00	6.47	T.
November	44.4	82	−4	3.37	3.90	3.00	.8
Fall	56.7	105	−4	9.26	7.00	11.47	.8
Year	55.0	111	−20	40.86	27.95	59.06	27.4

The outstanding features of Gibson County climate are well-marked seasons with hot summers and cold winters (seasonal range

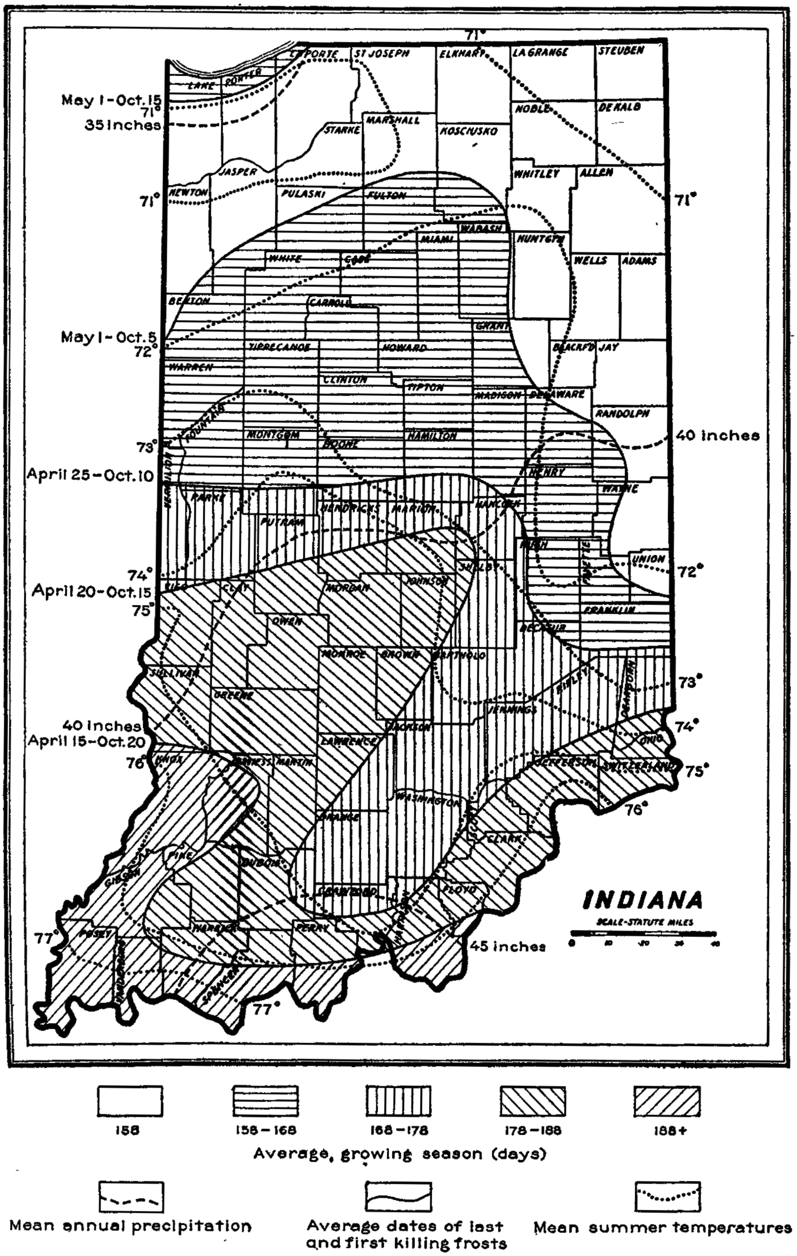

FIG. 35.—Sketch map showing climatic data

of temperature is 42.7° F.), with frequent changes due to the passing of about 20 cyclonic storms (not tornadoes) over the county each year.

Cold snaps are of short duration and snow does not lie long enough on the ground to afford much protection to winter grains. Although the daily range of temperature in winter is only about 15°, it frequently fluctuates across the freezing point, so that the land thaws by day and freezes by night. This increases the weathering or disintegration of the soil particles, loosens the soil, and increases erosion by winter rains. The frozen crust of earth heaves and breaks the roots of clover, wheat, and other winter crops, killing the plants in places. This damage is less on well-drained lands. The moderately cool weather is favorable to the stooling of wheat; but during the period that oats are on the ground, it frequently becomes too warm for the good of that crop. Early fall frosts sometimes damage the corn on the bottoms, especially where a wet spring delays planting. Normally the growing season is long enough for all the crops grown in the county.

During summer the daily range of temperature is about 20°. Relative humidity during the day is about 70 per cent, and at night the air becomes saturated. Clouds and haze help conserve the heat, so that the high temperatures of the long summer days last well into the short nights, and the coolest time of day comes at dawn. Such hot, sultry weather is uncomfortable for men and work animals; but it is fine for the growth of corn, which is best when the soil temperature is above 75° F. The high humidity checks transpiration and to some extent evaporation. Evaporation from open water is 50 inches per annum, or more than the annual precipitation. Only half of the rainfall comes during the growing season, and this often comes during sudden, hard thunderstorms. Thus much of the summer rainfall tends to run off rapidly. Although May, June, July, August, and September average between 3 and 4 inches of rain each month, prolonged droughts sometimes occur at critical times. From the point of view of the water requirements of corn and other crops, types of soil and conservation of rainfall and soil moisture are of increased importance in this county.

Gibson County receives about 55 per cent of the greatest possible number of hours of sunshine each year. One-third of the days are classed as clear, one-third as partly cloudy, and one-third are cloudy.

The average velocity of the wind is about 8 miles, and it seldom exceeds 40 miles an hour. In this part of the country tornadoes are rare. The prevailing winter winds are from the southwest.

AGRICULTURE

Gibson County has been one of the leading agricultural sections of the State since pioneer days, because of accessibility to settlers and favorable topographic, soil, and climatic conditions. The fine stand of original timber was an important source of income to landowners subsequent to the period when fields were cleared by burning the logs on the ground. Although some fields have been under cultivation for over a century, there are many fields, naturally poorly drained, which have been cleared and cropped only in recent years. At present about 66 per cent of the county is in cultivated crops and the remaining 34 per cent occurs as follows: Permanent pasture, 4 per cent; temporary pasture, 9 per cent; fallow land, 11 per cent; orchards, 1 per cent; woodland, 3 per cent; and waste land, 6 per cent.

The outstanding economic feature of Gibson County is revealed in the fact that crops constitute the source of over 64 per cent of the farm income, and livestock the remaining source. In the order of importance, the livestock products are as follows: Animals sold, poultry and eggs, and dairy products.

In wheat acreage Gibson County usually ranks about fourth and in corn acreage about seventeenth among Indiana counties. Gibson County is a part of one of the leading winter-wheat producing regions in the United States. These two major crops, together with hay—including timothy, mixed timothy and clover, and clover alone—and oats, occupy more than 90 per cent of the total cropped area of the county. The general status of agriculture has been determined, no doubt, by climatic and economic conditions; but on individual farms the kind or method of farming often reflects the influence of soil types.

Considering special crops, which occupy less than 5 per cent of the area, Gibson County stands out as one of the leading centers of melon production in the United States, producing over one-fourth of the watermelons and about two-fifths of the cantaloupes of Indiana. This special industry is found only on the belt of sandy lands along the Wabash Valley bluffs and bottoms. Although it was formerly confined largely to the lighter sands, varieties have been found adapted to the heavier and lower sands and sandy loams, and the planted area has expanded accordingly. The melon business naturally fits in with the growing of cowpeas for seed, so that over 6 per cent of the State's crop is grown here. Another fortunate circumstance for the densely settled melon district is that the "sand farmers" can plant 40, 60, or 80 acres of corn on near-by low, productive bottom lands which are sparsely populated because of overflows. This gives feed or another cash crop, and diversifies their activities.

Gibson County also has a high rank in the State in the production of tomatoes, which centers around the tomato-catsup factory at Princeton. As is usually the case, tomatoes are grown on many types of soil, but yields, quality, diseases, and cultural methods vary considerably with soil conditions.

Though alfalfa is still a minor crop, its acreage increased eightfold between 1910 and 1920. Other minor crops mentioned in the census of 1920 are: Rye, 734 acres; barley, 100; potatoes, 365; sorgo (sweet sorghum), 378 acres. Orchards of apples, pears, and peaches have been set out on many farms. These yield in favorable seasons, but are usually uncared for and hence unproductive.

Livestock on the farms includes about 9,000 head of work animals, of which less than a third are mules. There are also a number of young animals. Cattle number over 17,000, of which over half are dairy animals. Dairy products were marketed as milk, cream, and butter, a smaller part of which is "country" butter. The beef animals include some high grades of Hereford and Shorthorn. The number of hogs on Gibson County farms January 1, 1920, was 54,750, valued at $763,761. On the same date there were less than 4,000 sheep in the county.

As a rule the farm buildings and other equipment are good and ample for all needs. Some of the better houses are found in Montgomery Township. On overflowed lands houses, fences, and other

equipment are frequently in a "run-down" condition. As regards automotive equipment, 66 per cent of the farms have automobiles, 1 per cent have trucks, and 1.6 per cent have gas engines.

Corn, wheat, and grass form the basis of the rotations commonly practiced. Only about 1 acre out of 6 devoted to small grains is seeded to clover alone or to grass mixtures. Farmers have been feeling the need for something to "build up the land," and they have trouble in getting good stands of clover, because it may dry up after the nurse crop is removed or it may be winter killed. This condition, combined with active campaigning by agricultural extension workers, resulted in bringing into Gibson County what is said to be the first solid trainload of agricultural limestone in 1922. The need of fields for limestone depends much on the type of soil.

In the 1920 census 41 per cent of the farms reported the use of commercial fertilizers, costing on an average $86.48 per farm. This fertilizer consisting chiefly of acid phosphate and complete fertilizer composed largely of phosphate was used on wheat and to a less extent on corn at rates of from 100 to 300 pounds per acre. Melons also receive some commercial fertilizer.

In 1919 labor was employed on 63 per cent of the farms at an average cost of $353.19 per farm. It is drawn mostly from local sources, and is rather scarce and high priced.

There are 2,241 farms in Gibson County averaging 101.7 acres in size. Over 700 farms contain less than 50 acres, and only 6 have more than 500 acres. Of these 2,241 farms 59.3 per cent are operated by owners, 40.2 per cent by tenants, and 0.5 per cent by managers. Over 900 tenants pay share rent and 100 pay all or part cash rent.

Land values steadily and rapidly increased from 1880 to 1920. In the latter year the average assessed value per acre was $84.01, or 71.9 per cent of the value of all farm property.

SOILS

The soils of Gibson County, classified primarily according to soil characteristics, may be grouped as follows: Group I, soils with normally developed sections or profiles; Group I-a, soils, associated with those of Group I, which have developed on very flat areas and have peculiar and abnormal profiles; Group II, soils with poorly developed profiles, due to very poor drainage conditions, and which are marked by accumulation of organic matter in the surface layers; Group III, soils composed of alluvium deposited so recently that there has been little or no soil profile development.

The soils of Group I are upland soils which have developed normally under forest conditions. They are characterized by three distinct layers in the soil section, which are: (1) A top layer (A) which, under virgin conditions, has a surface veneer of organic matter, contains some organic matter in the upper part and less in the lower part, and is thoroughly oxidized and leached; (2) a middle layer (B) which is well oxidized and heavier in texture than the surface layer; and (3) a bottom layer (C) consisting of the parent material. The top layer has had much of the finer particles washed out of it, leaving the soil more friable, open, and coarse textured than the original or parent material. The middle layer

is heavier because in it have accumulated the fine particles which have been carried down from the top soil.

In this group of soils the degree of weathering depends partly on the openness of the material and of the freedom with which air circulates in it. The degree of weathering is greater in gravels and sands, and it is decreased when the B layer becomes too compact to permit free movement of soil moisture and air. Given the same materials and topography, the depth of weathering is thought to be somewhat proportional to the length of time the process has been going on. Topography determines erosion, and erosion hinders soil development. In situations where weathering proceeds with full effect without any material being added to or removed from the weathered products, soils exist which are termed "mature." In some cases the soils seem to have developed past the mature stage and have become "old" soils, being marked by impervious layers which retard aeration and drainage. Gibson, Tilsit, and Haubstadt soils have normal A and B layers, and in addition a more or less distinct impervious layer below. When erosion is active the entire A layer may be removed, or the A and B layers may never develop normal thickness.

The soils of Group I–a have A and C layers. In place of the normal B layers they have instead more or less definitely developed "hardpan" layers at varying depths of from 1 to 4 feet.

The structure of the various layers of the soils of Groups I and I–a is remarkably definite and uniform over large areas, and is distinct for each major layer of the section. The A layers show a distinctly laminated or platy structure. Clods of this layer will split along horizontal cleavage planes into thin plates. This cleavage is usually more distinct near the surface, and is lost at a depth of 6 or 10 inches below the surface, where layers exhibit a fine granular structure—apparently the work of worms.

The normal B layers show no laminations, but have very distinct irregular cleavage planes along which the moderately dry soil will split into small, irregular crumbs or fragments, usually less than one-fourth of an inch in diameter. The faces of these fragments are usually of a darker color than their interiors, otherwise the color is uniform and indicates good aeration.

In soils like the Tilsit silt loam the lower B layer does not have the cleavage quality, but is softer and perhaps lighter in texture. It is also more or less mottled with grays and browns, indicating poor aeration or drainage. In places there is a whitish layer of concentrated or partially segregated silty material just above the "hardpan." The hardpan has a very definite columnar structure. The upper vertical faces of the columns are separated by definite vertical cleavage planes, along which the whitish, silty material penetrates the layer. The surface of the fragments next to the cleavage planes or root channels is whitish, and just below the surface the color is yellowish, and in the central portions of the fragments the color is yellowish brown or rusty brown, with some dark iron concretions. The columns tend to unite at their bases in a very compact layer, slightly mottled and with few cleavage planes. Usually both the hardpan and the layer beneath it are more compact and heavier than the other layers of the section. In some cases the hardpan is merely compact rather than heavier in texture.

Below the hard layer is the upper part of the C layer, which is apparently lighter in texture, certainly less compact, and more yellowish and brownish in color, though there are distinct mottlings of gray, rusty brown, and even black colors. There is a fairly constant tendency for a concentration of black compounds at lower depths.

The lower part of the C layers represents parent material—till, bedrock, or loose silty material.

In the soils of Group II the mineral parent material has existed for a long period under comparatively quiet waters. There has been comparatively little addition of fresh sediments, although some silt and other fine materials have been washed in from higher land, especially along the margins of the soil areas, and some dust from the air has been deposited all over the areas. Most of the material which has accumulated consists of the remains of lake and marsh vegetation, which have been preserved in a greater or less degree, according to the depth of the waters. Decomposition is active at or near the surface of waters, but becomes negligible below. As a result of the conditions under which the soils of this group have developed, they are marked by (1) a high content of organic matter in their surface soils, (2) by a subsurface layer of parent material more or less modified by organic matter and washed-in sediments, and (3) by underlying original or parent materials.

The soil is naturally more or less water-logged, poorly drained, poorly aerated, and unoxidized. Such soils have developed under a cover of sedges, grasses, and other small water-loving plants, which helped to determine their character. The recent encroachment of forest trees on marsh lands have made little change in these soils. At this time, when much of this land is in well-drained productive farms, it is difficult for an observer to realize how very wet much of the county was a few years ago.

The soils of the Montgomery, Lyles, and Tyler series and Muck are representative of this soil group in Gibson County. Muck represents the accumulation of much organic matter, while Tyler represents soils that are on the border line, and tend toward Group I-a in character.

Soils composed of recent alluvium, as those in Group III, show little or no indications of having weathered zones, although the parent material, when laid down, consisted largely of more or less soil and subsoil material washed from the uplands. These soils support luxuriant vegetation, and yet they do not have distinct surface humus layers. They show cross-bedding and many horizontal layers which are the result of sedimentation under varying flood conditions. The nature of the materials is determined by the character of the uplands from which they have come, and they have been modified by the assorting action of the varying stream currents. In backwater situations the alluvium has been subjected to conditions giving rise to the soils in Group II, as in the case of the Sharkey soils. In Gibson County there is an unusually large area of old high-bottom land where alluvium has been subjected to conditions described under Group I, as in the case of the Elk soils. In such cases weathering forces are beginning to develop definite soil characteristics.

The following classification of the soils of Gibson County will serve as a key to the discussion of soils, which follow:

Group I.—Well-drained soils having normally developed profiles, including the following series: Bainbridge, Buckner, Elk, Princeton, Owensville, Haubstadt, Gibson, and Tilsit.

Group I–a.—Well-drained soils, on flat areas, having peculiar and abnormal profiles, including the following series: Vigo, Lickdale, McGary, Robertsville, Robinson, and Calhoun.

Group II.—Poorly drained soils having poorly developed profiles, including the following series, together with Muck; Tyler, Montgomery, and Lyles.

Group III.—Soils consisting of comparatively recent alluvial deposits, including the following series: Lintonia, Genesee, Huntington, Holly, Waverly, and Sharkey.

Bainbridge soils have light-brown to brown friable surface soils and heavy, yellowish to reddish-brown subsoils which become more reddish, friable, and usually sandy with depth. They include the best-drained portions of the assorted glacial terrace deposits. Their profiles are acid throughout.

The Buckner series includes dark-brown to black, friable surface soils, underlain by heavier brown layers, which at lower depths become more friable and lighter in texture and contain some lime. These soils occupy well-drained, old bottoms which are seldom subject to overflow. This series differs from the Warsaw soils in that the latter series is characterized by a heavy, reddish B layer, underlain by unweathered calcareous gravel.

The Elk series corresponds to the Buckner series in many respects, but in color it is light brown. It is characterized by a subsoil that is heavier than the surface soil and by the absence of the reddish, heavy subsoil and the dry, calcareous, gravel substratum which mark the Fox soils found on similar terraces along the glacial streams of Indiana. The Elk soils have developed largely from stratified deposits.

The Princeton soils occupy rolling uplands. They have light-brown surface soils and yellowish to slightly reddish-brown and heavier subsoils. The deeper substrata are friable and calcareous. The parent material is "marl-loess."

Soils of the Owensville series have developed from the same parent material as those of the Princeton series, but the former soils have limy layers within 3 feet of the surface and have subsoils more yellowish in color than those of the latter soils.

The soils of the Haubstadt series are much like the Gibson and Tilsit soils, in that they are characterized by a light-brown surface soil and a yellow or yellowish-brown, heavier subsurface layer, which in turn is underlain by a mottled layer which tends to become hardpan. The deeper substratum materials consist of stratified, assorted Illinoian lake deposits.

The Gibson series is characterized by a light-brown or yellowish-brown surface soil and a heavier yellow subsoil, underlain by a noncalcareous, Illinoian till, mottled with yellow and gray. This till extends to a depth of about 10 feet. The lack of lime at shallow depths distinguishes this series from the Owensville series, and the character of the parent material and the lower substrata separates it from the Tilsit series.

The distinguishing features of the Tilsit series are a light grayish-brown surface soil and a brownish-yellow, heavier, compact subsoil

which becomes more friable and mottled with depth and grades, through partly weathered rock, into unweathered shale and sandstone, to depths of from 8 to 10 feet. These soils occupy sloping to rolling upland which is more or less subject to erosion.

The Vigo soils have developed on flattish areas of Illinoian till. They have light-gray or brownish-gray surface layers, very light subsurface layers, and much heavier, compact subsoils, mottled with gray and yellow. The till is mottled and has been leached of lime to a depth of 10 feet or more.

The Lickdale soils are very much like those of the Vigo series in appearance. The former are derived from sandstones and shale, materials which may be found at a depth of 10 feet or more.

The McGary soils have light brownish-gray surface soils, light-gray subsurface layers, and heavy, yellow clay subsoils. At a depth of about 30 to 36 inches the subsoils change quickly to yellow or mottled, friable, calcareous materials, often containing lime concretions. They occur on slight rises on timbered lake plains and might be considered as terrace equivalents of Crosby soils.

The Robertsville soils correspond closely to the McGary soils, but are derived from less limy materials, and lack carbonates in the substrata to considerable depths. They correspond to terrace equivalents of Vigo soils.

The Robinson soils are similar to those of the Robertsville series, differing from the latter soils by unusually deep, friable, light-gray, surface layers. This depth of the surface layers makes the Robinson soils correspond to terrace equivalents of Clermont soils.

Calhoun soils are light brownish gray in color, with light-gray subsurface layers and heavier mottled gray and yellow subsoils. The parent materials are alluvial sediments which have been washed mostly from sandstone-shale uplands. These soils occupy old bottoms which are seldom inundated, and they correspond to weathered Waverly soils. The soils of the Calhoun series approach both Group II and Group III in character.

The Tyler soils have medium-gray or drab surface soils and lighter gray subsoils, mottled with yellow and rusty brown. They have developed from old Wabash River sediments lying in positions having intermediate drainage. Where the land grades into better drained areas, like those occupied by Elk soils, a brown phase of Tyler clay loam was mapped.

The Montgomery soils are derived from calcareous, glacial-lake deposits. The surface soils are medium to dark gray in color, and the subsoils are mottled with gray, yellow, and brown. These soils are productive.

The Lyles soils have dark-gray to black surface soils and subsoils mottled with gray, drab, and rusty brown or yellowish brown. They include poorly drained alluvial deposits of neutral or calcareous materials. They differ from the Sharkey soils in not being sticky and plastic.

Muck includes mellow, black, poorly drained soils derived in part from partially decomposed remains of marsh plants and in part from silt and sand. These soils are commonly neutral in reaction.

The Lintonia soils consist of light-brown friable material with deep subsoils of similar materials. They are to be found along the foot of bluffs, in terrace positions relative to the Wabash bottoms,

but are derived apparently from silt material washed from adjacent hills.

The Genesee soils include the best drained, brown sediments along streams, which sediments consist of calcareous materials washed from Wisconsin till uplands. These are productive soils.

The Huntington soils resemble the Genesee soils in being brownish, fairly well drained sediments, but differ from them in that the sediments are less calcareous in nature, being washed from uplands of loess, Illinoian till, and from sandstone and shale soils.

The Holly series includes light grayish-brown soils overlying subsoils that are mottled with gray, yellow, and brown. They consist of recently deposited sediments derived largely from sandstone, shale, and Illinoian till uplands.

The Waverly series includes very light-gray soils having lighter subsoils, which may be more or less mottled with pale yellow and rusty brown. They consist of noncalcareous sediments derived from sandstone, shale, and Illinoian till uplands. Like the Holly soils, they are less productive than the Genesee soils.

The Sharkey series includes drab to dark-gray soils having lighter drab subsoils that are more or less speckled with rusty brown. The soil material consists of calcareous, glacial sediments, and is marked by a high colloidal content, imparting an unusually sticky and plastic character to this land. Some phases of the Sharkey types approach the soils of Group II.

Soils have often been classed under the physiographic headings of upland, terrace, and bottoms. Such a grouping is important in pointing out the relation of soils to erosion, arability, overflow, and drainage. These divisions are distinct, well known, visible, and have much agricultural knowledge grouped about them. They indicate the distribution of soil types and they indicate also the forces to which the original soil materials have been subjected. This grouping of Gibson County soils according to physiography is as follows:

Upland: Princeton, Owensville, Gibson, Tilsit, Vigo, and Lickdale.

Terrace: Buckner, Elk, Bainbridge, Lintonia, Robertsville, Haubstadt, Robinson, McGary, Calhoun, Tyler, Montgomery, and Lyles.

Bottoms: Genesee, Huntington, Holly, Waverly, and Sharkey.

When classified on the basis of the nature of the parent materials soils may be grouped under (1) residual, (2) glacial, (3) loessial, and (4) water-laid. These classes are marked by differences in the lower part of the soil section. The character of residual materials depends much on the nature of the country rocks, such as limestones, sandstones, shales, igneous rocks, etc. In Gibson County the only extensive formations are sandstone and shale, since the thin limestone seams have been negligible as a source of soil-forming material.

Unassorted glacial deposits or till may be broadly divided into high-lime and low-lime (calcareous and noncalcareous) classes. The till of Gibson County is all correlated with the Illinoian period of glaciation. This till probably contained comparatively little limestone, since the nearest limestone formations in the path of the glacier lie over 30 miles to the northeast of Gibson County. Then, too, this till is so old that whatever carbonates it may have contained within a depth of 5 or 10 feet have been removed. Unmodified till

is rarely found in Gibson County, and foreign rocks, such as granite and diorite, are both scare and small.

The extent of loessial deposits in Gibson County is a matter of uncertainty and argument, but there is no doubt that the sandy uplands bordering the Wabash and White Rivers bluffs are wind-blown deposits. It is very evident that these dune-shaped hills were formed where strong northwest winds had the chance to sweep over sandy bottoms and terraces, carrying sands of certain size up onto the uplands. In some places these sand hills end in steep-faced terminal dunes, and in other places there are zones where the original silty soils have a veneer of sands. These sands are neutral or even calcareous in the lower layers, a striking contrast to similar sands in northern Indiana or to the other soils of the Illinoian glaciation which are naturally "acid."

The Wabash bottoms are calcareous because the materials of its drainage basin are largely lime bearing and because of the shell fragments washed from the river channel. The sandy uplands are not acid, because they have not been leached very much in the short geologic time since the sands were blown from the bottoms. The silt loams associated with the sand dunes in the belt several miles wide along the river bluffs are also probably loessial deposits to a depth of several feet. The silt and sand are interbedded in places and the silts may be underlain by very fine sand or coarse silt layers. Considerable quantities of calcium carbonate are found at depths varying from 3 to 10 feet, which, as in the case of the sands, point to the adjacent calcareous bottoms as the source of the material. Calcareous seeps occur on the slopes of these hills, accompanied by lime concretions and black soils.

These loessial soils have been in place long enough to have developed the distinct A and B layers that are characteristic of the aerated weathered soils of the region, but where evidences of abundant lime are found the parent material is more likely to be loessial than glacial. This material, called "marl loess," is ascribed to "fluvio-lacustrine" origin in the Patoka Folio of the United States Geological Survey. The theory advanced there may hold in part, but the occurrence of similar marly silt on the crest of Balls Hill (elevation 645 feet) and elsewhere indicates that it is not confined to a "broad terrace" below the "500-foot level." It is also believed that a mantle of "common" or noncalcareous loess covered all the land east of the Wabash Valley, "reaching a maximum thickness of about 15 feet, 6 miles from the bottoms and thinning to 2 or 3 feet 35 miles inland." This view finds some support in the fact that no soil samples from that part of Gibson County contained particles too coarse to pass a 2-millimeter sieve, whereas samples of similar types from Clay County contained a number of cherty fragments. However, east of the belt of limy soils the thickness of the silts or more or less weathered materials does not seem any greater than should be expected from the long weathering of old, unconsolidated till composed chiefly of soft rocks, or from the weathering of the shales and sandstones exposed in southeastern Gibson County. The surface soils of moraines, lake basins, outwash plains, bottoms, and residual hills are uniformly silty, probably because of a loess mantle or because uniform weathering, acting through a long period, has produced a

uniform soil. However, for purposes of soil classification it makes little difference whether the parent material is of glacial or loessial origin. When it is difficult to determine, as in this case, the use of the term "loessial" in this report is restricted to those areas where lime has been found in the lower layers, although other soils are believed to be calcareous at depths below the reach of a 3-foot auger.

On the basis of the nature of the parent materials the soil series of Gibson County may be grouped as follows:

Residual: Tilsit and Lickdale.

Glacial: Gibson and Vigo.

Loessial: Princeton and Owensville.

Water-laid: Bainbridge, Buckner, Elk, McGary, Robertsville, Haubstadt, Robinson, Calhoun, Tyler, Montgomery, Lyles, Lintonia, Huntington, Genesee, Holly, Waverly, and Sharkey.

The water-laid soils may be divided into two subgroups, namely, those derived from calcareous sediments and those derived from noncalcareous sediments. The calcareous sediments were deposited by the Wabash and White Rivers and by glacial waters, while the noncalcareous sediments were laid down by the Patoka River and other small streams having their origin almost wholly in the sandstone-shale uplands. These water-laid sediments now occur as lake plains, outwash plains, old and recent river flood plains.

In the soil survey of Gibson County the distinctions between uplands, terraces, and bottoms are carefully drawn, and the soil series are established on the basis of origin, color, structure, surface drainage, and underdrainage, as evidenced by surface indications and the various layers of the soil section.

The table below gives the names and the extent of the several soil types of Gibson County. The distribution of the soils is shown by means of colors on the accompanying map. In the pages following the individual soils are discussed in detail, including their relation to agriculture.

Areas of different soils

Soil	Acres	Per cent	Soil	Acres	Per cent
Gibson silt loam	47,808	16.9	Calhoun silt loam	4,672	1.5
Rolling phase	5,632		Owensville silt loam	3,392	1.1
Tilsit silt loam	33,536	11.8	Robinson silt loam	3,392	1.1
Steep phase	2,432		Buckner silt loam	3,072	1.0
Eroded phase	1,152		Genesee fine sandy loam	2,944	.9
Princeton silt loam	17,856	7.7	Sharkey clay loam	2,880	.9
Steep phase	6,784		Calhoun silty clay loam	2,816	.9
Holly silt loam	22,144	7.0	Lintonia silt loam	1,472	.8
Montgomery silt loam	12,544	5.4	Light phase	960	
Dark-colored phase	4,672		Sharkey silty clay loam	2,176	.7
Sharkey clay	12,864	4.4	Calhoun clay loam	1,792	.6
Poorly drained phase	704		Lyles silt loam	1,600	.5
Mucky phase	448		Elk loam	1,408	.4
Genesee silty clay loam	10,816	4.1	Lyles fine sandy loam	1,280	.4
Poorly drained phase	2,368		Elk silt loam	1,216	.4
Haubstadt silt loam	12,864	4.1	Tyler loam	704	.4
Waverly silt loam	12,608	4.0	Brown phase	448	
McGary silt loam	12,224	3.8	Elk fine sandy loam	960	.3
Huntington silt loam, shallow phase	9,408	3.0	Vigo silt loam	896	.3
Robertsville silt loam	8,768	2.7	Buckner silty clay loam	832	.3
Genesee silt loam	7,936	2.5	Lickdale silt loam	704	.2
Tyler clay loam	5,120	2.1	Bainbridge silt loam	640	.2
Heavy phase	128		Buckner loam	576	.2
Brown phase	1,408		Lyles loam	576	.2
Elk fine sand	5,760	1.8	Tyler sandy loam	576	.2
Princeton fine sandy loam	5,568	1.7	Muck	320	.1
Princeton fine sand	5,504	1.7	Vigo fine sandy loam	256	.1
Montgomery silty clay loam	5,184	1.6	Total	316,800	

PRINCETON FINE SAND

Princeton fine sand consists of from 5 to 9 inches of loose, fine sand or loamy fine sand, light brown to brown in color, and underlain by light yellowish-brown, loose, fine sand extending to a depth of 5 feet or more.

In places occur, at various depths, layers which represent the surface of soils that have been buried by more recently drifted sands. Elsewhere this type resembles the Princeton fine sandy loam, and is underlain by a layer of heavier material at a depth of 3 or 4 feet. The Princeton fine sand is distinguished from the higher parts of adjacent Elk fine sand chiefly on the basis of topography and physiographic position.

The topography of the areas of Princeton fine sand is dunelike, with irregular slopes, usually more gentle on the face toward the "bottoms" and more precipitous on the side leading toward the uplands. There are a few deep pockets surrounded by dunes, but they are well drained internally, and present very little soil difference, as compared with the higher areas of the type. There is comparatively little run-off from the steep slopes, because water is so readily absorbed.

This type has approximately the same distribution in the county as the Princeton silt loam, being scattered along the river bluffs. The largest areas lie southwest of Johnson.

Only a small proportion of this type is still in forest. Forest growths consist of smaller trees of the original species, with undergrowths of grapevines and other smaller plants. Most of the type is intensively used for the production of cantaloupes and watermelons, which are shipped to all points in the surrounding territory. Netted Rock and Tip Top are the most common varieties of cantaloupes, and the Tom Watson and Monte Cristo are the most popular watermelons. Cowpeas is another important crop on this type. They are harvested for seed or hay and are used to improve the comparatively thin sandy lands. Tomatoes are grown to some extent, and there are several large peach orchards on the type. Rye is sown as a winter cover crop. This type gives large returns from the special crops, and comparatively little of it is used for the staples.

Manure and complete commercial fertilizers are used on the special crops in larger quantities than on the crops which are grown in the general-farming sections.

The farm values are comparatively high, because of the type of farming. There is frequently a set of buildings to 40 or 20 acres of land in this section.

PRINCETON FINE SANDY LOAM

Princeton fine sandy loam, as mapped, includes all the sandy uplands where there is a heavier subsoil within 3 feet of the surface. Two different developments of this type are encountered. In places the soil has been developed from rather deep sandy materials in which there was originally some silt, clay, and carbonate. This is indicated by the formation of a lower zone of clay. In other places the type has developed on areas over which sands had accumulated as

a veneer over some heavier upland material, like that which has given rise to Princeton silt loam, for example.

In most places there is a distinct well-developed soil profile. The surface layer consists of light-brown or light yellowish-brown loamy fine sand or fine sandy loam, in places becoming a slightly reddish-brown, shallow, fine sandy loam or loam. The subsoil consists of yellowish-brown to slightly reddish-brown fine sandy clay loam, which is compact when dry. Below the subsoil, at a depth of 30 inches or more below the surface, is a yellowish-brown material having the quality of a friable fine sandy loam. The lower portion of this material in places contains looser sands varying in texture, and enough lime carbonate to effervesce with acid. Where this type borders the Princeton fine sand, the surface layer may be 2 feet thick.

Princeton fine sandy loam is mapped along the bluffs, and it also occurs in strips and patches, too small to map, between areas of Princeton fine sand and Princeton silt loam.

The topography is irregularly undulating or sloping, and is, in most places, less steep than that of the Princeton fine sand. The surface drainage is good, and the subsoil is porous enough to insure good underdrainage and aeration.

Most of this type is cleared of the original forest, and is cultivated. It is used for the production of many different crops, since it is fairly well adapted to melons and other special crops, as well as to the general farm crops of corn, wheat, and hay. The Irish Gray variety of watermelons yields better on this type than the other varieties, and it is one of the best for shipping.

PRINCETON SILT LOAM

The surface layer of Princeton silt loam consists of a friable silt loam 8 or 10 inches thick. In virgin areas the upper 3 or 4 inches has a medium-brown color, and below this the color is light brown or yellowish brown. When the soil is wet its color is darker, and cultivated fields may assume a reddish-brown cast. The subsoil, to depths of from 30 to 36 inches or more, consists of brown or slightly reddish-brown, friable, moderately firm, silty clay loam. Typically it is not mottled. There is a rather abrupt change from the subsoil to the material beneath it, the latter consisting of yellowish-brown, friable, silt loam or, at lower limits, very fine sandy loam. At depths ranging from 30 to 60 inches below the surface, free carbonates are found in quantities up to 15 per cent. In some places small lime concretions are present, and the calcareous layer is usually marked by light-gray, brown, and pale-yellow colors. Road cuts in areas of this type show the smooth, uniform, and well-preserved structural characteristic of loess.

Princeton silt loam is the dominant soil type in a belt of country, 1 to 3 miles wide, bordering the bottoms of the White and Wabash Rivers. A few smaller areas of the type are scattered farther to the east. It occupies the more rolling areas at elevations ranging from the lowest to the highest uplands. Although the surface is generally rolling or undulating and well drained by numerous small streams and their branches, it is seldom too steep or gullied for

cultivation. Erosion is less serious on this type than on some other types with slopes no steeper.

The Princeton silt loam is one of the more important and better agricultural soils of Gibson County. It was originally heavily timbered with white oak, black oak, hickory, tulip, black walnut, and other hardwoods. Most of it has been cleared and cultivated for many years. The principal crops are corn, wheat, timothy, clover, and oats, and the yields are usually above the average for the county. It is also used for alfalfa with good results. Tomatoes are another important minor crop. Some orchards of apple, peach, and pear are on this land. Farms located on this type are well stocked with beef cattle, dairy cattle, and other livestock.

A high-phosphate fertilizer is commonly applied on wheat, and less frequently on corn, at the rate of from 150 to 200 pounds per acre. Crushed limestone has been applied to some small fields for alfalfa and clover.

Land values on this type range from $100 to $200 an acre.

Princeton silt loam, steep phase.—The steep phase of Princeton silt loam has much the same soil profile as typical Princeton silt loam, except that it is less mature. The typical soil has been developed from deep, friable, calcareous, well-drained silty material, while the phase, located in much steeper topographic positions, has failed to develop the normal thickness of the layers, owing to loss by erosion.

This phase, which is associated with the typical soil, occupies the roughest parts of the river bluffs. It is gullied and dissected by deep, narrow ravines in which are many lime-bearing springs. Much of the phase is forested with trees of the original species, the large merchantable trees having been removed. There is often an undergrowth of bushes and vines. Part of the phase is in grass, and as a whole the land is used for woodland and pasture land for hogs, cattle, and sheep. Some small fields are in crops, particularly timothy and clover; and there are some orchards on this land. The value of this steep land is generally low.

OWENSVILLE SILT LOAM

Typical Owensville silt loam consists of a brown to yellowish-brown surface layer of friable silt loam which becomes, with depth, light brown or yellowish brown in color. At a depth of about 10 or 12 inches below the surface a heavier subsoil is encountered, consisting of dull yellowish-brown silty clay loam. In places the subsoil is mottled with faint grayish brown and contains some small, soft iron concretions. At a depth of about 32 inches there is a sharp dividing line between the subsoil and the parent material below, the latter consisting of a friable material having a silt loam texture and colored pale yellow, yellowish brown, light gray, or light brown. This lower material is calcareous, and soft lime concretions are distinguishable in it in many places.

The principal type variations occur where this soil approaches the color and depth characteristics of the Princeton soils, or where it merges into Gibson silt loam. A few areas bordering lake plains are hard to distinguish from McGary silt loam.

The largest areas of Owensville silt loam are mapped on the lower slopes of the Maumee Creek valley, northwest of Owensville, and in similar locations associated with the belt of Princeton soils.

The topography is gently sloping, and the drainage is good. All the type is under cultivation. The leading crops are corn, wheat, timothy, clover, and alfalfa, the latter being probably more extensively and successfully grown on this soil than on any other type in the county. Liming is not necessary on this kind of soil, since in typical Owensville silt loam ample lime lies within reach of the plant roots. Phosphate fertilizers are generally used for wheat, and often for corn.

On this kind of soil land values range from $100 to $200 an acre.

TILSIT SILT LOAM

Tilsit silt loam is characterized by a surface layer of friable, light grayish-brown or brown silt loam—changing a few inches below the surface to light yellowish brown—and by an underlying material of moderately compact, heavy silt loam or silty clay loam, light yellowish brown in color, the lower portion of which being mottled with gray and brown. Below this second layer, at a depth of about 20 or 24 inches, the material becomes a very heavy silty clay loam or silty clay, hard and brittle when dry and plastic, and impervious when wet. It has a yellowish-brown color, mottled with light gray and dark rusty brown. In road cuts light-gray silty material may be seen along the joint planes in this lower subsoil. Deeper down the material is usually lighter in texture and more friable than the overlying stratum, especially when the parent rock is coarse-grained sandstone. Commonly the parent rock is very fine textured and forms heavy weathered products down to the bedrock. The lower weathered material in many places retains the original form of the parent rock, and breaks along similar irregular, horizontal cleavage planes, forming shaly fragments which are highly colored on the surface with black and dark-brown iron and possibly manganese compounds. The hard bedrock appears at an average depth of 8 feet.

Tilsit silt loam is mapped only in the southeastern corner of Gibson County, where it occupies most of the upland area. It is the "yellow clay, freestone hill land" of Indiana.

The topography is moderately rolling, with varying slopes from the rounded divides to the numerous streams which form a drainage network. Although the surface drainage is good, the silty surface soil traps rainfall. Because of the large quantity of water retained by the impervious subsoil and also by the bedrock, the soil is a rather cold, wet, and late soil. It becomes saturated from heavy winter rains and it does not become dry enough for cultivation until much later in the spring than many other soils of the county. Moreover, during the summer, when the soil becomes dry, little moisture remains stored in the comparatively shallow layer of weathered material; so that timely rains are needed to supply the water needs of growing crops. The streams usually dry up in the summer and fall.

Tilsit silt loam has developed under a forest cover of white oak, post oak, black oak, hickory, persimmon, maple, and other hard-

woods. Native vegetation on cleared lands includes sedges, sassafras, brambles, cinquefoil, poverty grass, and lespedeza. Only small groves and woodlots remain to show the character of the original forest.

Tilsit silt loam is one of the more extensive and important soil types in Gibson County, and it is even more important in the counties of unglaciated Indiana. The appearance of the farms on this type, as a whole, does not indicate agricultural prosperity. There are many idle fields. Corn, not so extensively grown as on the better types of the county, yields from 25 to 35 bushels per acre. Wheat is an important crop, yielding from 10 to 20 bushels per acre. Timothy and redtop are the common hay grasses. Clover does not do well unless the land is limed, and this practice is not at all common. Phosphatic fertilizers are used for wheat and corn. The Francisco Experimental Field, under supervision of Purdue University Agricultural Experiment Station, is situated on this type of soil.

The average value of this type in normal times is about $50 an acre.

Tilsit silt loam, eroded phase.—The eroded phase of Tilsit silt loam is practically the same as the typical soil, except that areas thus mapped have been more or less damaged by gullying and sheet erosion, removing part of the surface soil and exposing the subsoil. The phase is not confined to steep slopes, but may occur where poor soil management has resulted in erosion damage that might have been prevented. The heavy winter rains soften the soil and the frequent freezes and thaws loosen it, so that the surface easily washes away.

The eroded phase is mapped as several small areas in the southeastern part of Gibson County. Besides these areas there are numerous patches, too small to indicate on the map, included in areas of the typical soil. As would be expected, similar patches are included in areas of the steep phase.

This phase is used mainly for pasture. Some attempts to grow corn and wheat on the better areas of this eroded soil have been made. Black locust is planted in thickets for fence posts and for checking erosion. Sweet clover makes a fair growth when seeded in the gullies, and lespedeza is naturally spreading over many eroded spots, serving to hold the soil and to improve the pasturage.

For farming this eroded soil is worth very little, though it may be improved.

Tilsit silt loam, steep phase.—The steep phase of the Tilsit silt loam is separated from the typical soil mainly on the basis of topography. It should be noted that in this phase and also in other phases and types of the Tilsit series thin beds of limestone may occur in the parent rock. These, however, rarely affect the surface soils over any large area. The main evidences of the presence of limestone, which may be observed in deep road cuts, consist of fragmentary outcrops of hard rock a few inches thick and, in places, of variegated, calcareous clays a few feet thick.

In soil sections of the step phase soil may be seen in different stages of maturity or of oxidation. Some stages are typical of the Tilsit series, though the soil layers may be thinner than normal, or the lower layers may be undeveloped (with the bedrock within 3 or 4

feet of the surface), or the surface layer may be lacking, having been removed by erosion. In some places, as on the breaks of the steeper slopes or where more porous or ferruginous parent material is found, the soil section presents the well oxidized, yellowish to slightly reddish-brown color of the Muskingum series, not mapped in Gibson County.

Areas of the steep phase are mapped in the southeastern corner of the county on the higher and steeper slopes of the prominent hills in that section. The slopes often drop 80 to 120 feet in one-eighth to one-fourth mile, and are cut into irregular forms by numerous drainage ways that head in these areas. The run-off is very rapid. Though this phase has been eroded in many places, it is now protected from washing by grasses, sedges, weeds, and bushes. A part of the land is in forest. A few small patches are mapped in the glaciated part of the county, where residual material is exposed on the slopes; and numerous strips too narrow to map are included in the mapped bodies of typical Tilsit silt loam. This phase is better adapted for use as pasture and forest lands than for growing cultivated crops. The value of such land is low.

GIBSON SILT LOAM

Gibson silt loam consists of about 8 inches of friable silt loam, ranging in color from light brown or grayish brown in the upper part to light yellowish brown below. The subsoil is a light yellowish-brown, friable but rather compact, silty clay loam, becoming a little heavier with depth and mottled with light gray and brown below 20 or 24 inches. Underlying the subsoil, beginning at a depth of about 30 inches, is a more friable silty clay loam mottled like the soil layer above it. Some glacial bowlders and small quantities of gravel and sand are found in this substratum. Some deposits of reddish sandy material appear in cuts, as north of Oakland City.

The boundary between areas of the Gibson silt loam and Tilsit silt loam is hard to determine because of the difficulty in determining the nature of the lower portion of the stratum underlying the subsoil. In general it follows the limits of glaciation as determined by geologists, but diverges in places. Thus Gibson silt loam includes the smoother, less eroded, and apparently the more productive land. In the more rolling country south of Hazelton the soil color approaches that of the Princeton soils, but because of the general absence of a loose calcareous subsoil and substratum, the soil was mapped as Gibson silt loam. Other areas of Gibson silt loam, such as those associated with the Princeton soils near Owensville, include patches of Owensville silt loam. Mapped areas of Gibson silt loam include patches of its phases and of associated types.

Gibson silt loam is the dominant upland soil, forming a central belt which extends across the county in a north and south direction. This belt includes the terminal and ground moraines. The topography is gently sloping or rolling. The surface is well drained, the drainage ways leading onto lower lands and into broad shallow heads of the main drainage system. Underdrainage is sluggish.

The Gibson silt loam is one of the most extensive and important agricultural soils of Gibson County and of sections to the north.

Because of its good natural drainage this land has long been cleared and cultivated. A few small woodlots remain. Corn and wheat are the main crops, the former yielding from 30 to 60 bushels and the latter from 15 to 25 bushels per acre. The hay produced consists mostly of timothy, since clover does not do very well. Tomatoes are being grown on a commercial scale on some farms on this type. Some oats are grown, but this grain can not be called a successful crop for southern Indiana except in very favorable seasons.

In very recent years the practice of applying ground limestone to this type of soil has increased rapidly, owing to the benefit to clover and other legume crops, such as alfalfa, and because of subsequent improvement in the yields of other crops. Commercial fertilizers, containing from 8 to 20 per cent of phosphoric acid and often a little soluble potash and nitrogen, are applied at the rate of from 150 to 200 pounds per acre on wheat and to a less extent on corn.

The value of this type ranges from about $75 to $150 or more an acre, according to location and improvements.

Gibson silt loam, rolling phase.—The rolling phase of Gibson silt loam is purely a topographic separation comparable to that made in case of the Tilsit silt loam. The soil profile is similar to that of typical Gibson silt loam.

This kind of land is largely in pasture, hay fields, and timber, which protect the land from erosion which becomes active in fields devoted to wheat or corn. Some successful apple orchards are on this land.

The value of the land is usually less than $100 an acre.

VIGO FINE SANDY LOAM

Vigo fine sandy loam, as mapped in Gibson County, includes "poorly drained sandy upland." This type occurs in Clay County and also in several other counties in Indiana, where the sands, drifted from the Wabash and White Rivers bottoms, have veneered flat uplands. The color of the surface layer is a shade of bleached-out gray, ranging from very light to medium. This top layer grades into light-gray fine sandy loam or loamy fine sand which is more or less streaked with rusty brown. The sandy soil is 10 inches or more in depth, and is underlain by a subsoil of loam or sandy loam, mottled with light gray and yellowish or rusty brown. The lower parent material is probably glacial drift.

The type is mapped as a number of small areas along the margin of the sandy-land belt near the river bluffs. The surface is flattish and is depressed below the surrounding soils. Probably little water can pass downward through the heavier subsurface layers, but it may move horizontally toward lower levels.

This type is inextensive. It is distinct from the other soils of the county. It is too wet for melons, and ordinarily it is used for the production of timothy, corn, and wheat. It is acid and not very productive even in normal seasons.

Associated with this type are a few small areas having springs which issue from sand dunes, the water apparently carrying lime. In these places darker sandy soils or even mucky soils have developed, but the patches are too small to indicate on the map.

VIGO SILT LOAM

The top layer of Vigo silt loam consists of a light brownish-gray, friable silt loam, overlying a very light-gray or almost white silt loam, both layers forming a surface soil ranging in thickness from 3 to 12 inches. More or less black, iron concretionary material is found in this and lower layers, but the quantity of such material decreases with depth. The deeper material, to a depth of about 32 inches, is a heavy, compact, impervious silty clay, mottled with light gray, yellowish brown, and rusty brown; and below this depth the material is slightly lighter in texture and becomes more yellowish with depth. The parent material, underlying the subsoil, is old glacial drift resting on bedrock.

Areas of Vigo silt loam lie in the glaciated part of the county in the vicinities of Oakland City and Haubstadt. The topography suggests the remnants of a more extensive plain, now dissected; and the type areas occur only on the main divides, as yet uneroded. Where they form basins above drainage heads the areas are flattish to slightly depressed. Water runs off rather slowly into "draws," and it is held in the soil above the impervious layer, making it waterlogged and cold.

Vigo silt loam is too inextensive and naturally unproductive to be of any agricultural importance in Gibson County. The few small areas are cleared of the original growth of black oak, white oak, beech, and other hardwoods, and are used for the production of hay, wheat, or corn. The average yields, especially of corn, are lower on this soil than the county averages. The valuation of this type depends largely on the associated soils, location, and farm improvements.

LICKDALE SILT LOAM

The surface soil of Lickdale silt loam consists of a top layer, a few inches thick, of light brownish-gray, friable silt loam underlain by a layer of very light-gray to almost white silt loam. The surface soil, including the two layers, has a thickness of about 12 inches. It contains more or less black iron concretionary material, the quantity decreasing with depth. The surface soil is underlain by an impervious silty clay, the subsoil, mottled with light gray, yellowish brown and rusty brown. The subsoil extends to a depth of about 30 or 35 inches, and is underlain by the parent material which consists of somewhat decomposed noncalcareous shale.

This type is developed on small areas, mainly in the southeastern part of the county and within the drainage basin of Pigeon Creek. The topography is flat, being essentially the same as that of Vigo silt loam. The agricultural value of this soil is practically the same as that of Vigo silt loam.

MONTGOMERY SILT LOAM

Montgomery silt loam has an 8-inch top layer of medium to dark grayish-brown, friable silt loam overlying a layer of dark grayish-brown friable silty clay loam mottled with gray and brown. At a depth of about 16 inches the subsoil consists of a semiplastic, heavy silty clay loam or silty clay, mottled with light gray, yellowish

brown and brown. The subsoil is underlain by lacustrine silts and sands for many feet. The material is calcareous at varying depths of from 3 to 5 feet.

Montgomery silt loam is the dominant soil of the large flats or glacial-lake plains located west and southwest of Fort Branch and south of Hazelton. Surface drainage and underdrainage are naturally poor, but ditching and tiling have transformed this type into well-drained land, more like upland than bottom land.

This is an important soil not only because of its rather large extent, but also because of its favorable topography and productiveness. It is used for general farming, including the production of corn, wheat, timothy, clover, oats, and tomatoes, and the feeding of hogs and cattle. The yields are well above the county average.

Some commercial fertilizers are used for wheat. Clover can be grown without liming.

The value of land of this type ranges from about $150 an acre to more than $200, according to improvements.

Montgomery silt loam, dark-colored phase.—The surface soil of the dark-colored phase of Montgomery silt loam consists of a top, 8-inch layer of dark grayish-brown, friable silt loam, which grades into a dark silty clay loam, mottled with gray and brown below 16 inches. Below 24 inches the material is silty clay loam to silty clay, mottled with light gray, brown, and yellowish brown. At depths of from 4 to 5 feet the material is normally colored more yellow and brown and contains enough lime to cause effervescence with acid. This kind of soil occupies two distinct topographic positions, one in association with the Owensville and Princeton silt loams, and the other is associated with the Montgomery and McGary silt loams.

The dark-colored phase of the Montgomery silt loam is mapped chiefly on the big flats west and northwest of Fort Branch and Haubstadt, where it occupies the lowest and most poorly drained areas. Other areas occur southwest of Owensville as flattish to gently sloping land along the lower hills.

This soil is all cleared and under cultivation. Corn, wheat, timothy, clover, oats, and tomatoes are the leading crops. The average crop yields are above the average for upland types, especially those of corn and clover. Since this soil is "sweet," little difficulty is experienced in growing legumes on well-drained fields. The value of such land ranges from $150 to $200 an acre.

MONTGOMERY SILTY CLAY LOAM

Montgomery silty clay loam has a two-layer surface soil consisting of, (1) about 8 inches of medium-gray or grayish-brown, heavy silt loam or silty clay loam, and (2) a layer of silty clay loam mottled with gray, yellowish brown, and brown. Darker shades indicating organic matter are usually absent below 20 inches, where the material is silty clay loam or silty clay mottled with yellowish brown, light gray, and brown. This subsoil continues downward to the marly clay parent material. The surface soil may be lighter in texture on approach to the Holly silt loam, where it is less calcareous below. In some of the lower areas the surface soil may be dark gray, with lime at a depth of about 36 inches. In places some patches of a very deep, dark silty clay loam or silty clay are included.

This type occurs as several large areas in the Patoka River bottoms, east of the town of Patoka, the parent materials being glacial-lake deposits rather than recent sediments. The topography is flat and the natural drainage is poor. Some water drains onto the type areas from adjoining hills, and the river sometimes overflows. However, the deeply dredged ditch, which has reduced about 50 miles of Patoka oxbows to about 18 miles of straight channel, has greatly improved the drainage.

Montgomery silty clay loam is a very productive soil. Corn on such land will probably average 50 or 60 bushels per acre, it having yielded over 100 bushels per acre in 5-acre corn club work. Wheat yields from 20 to 25 bushels or more per acre, and red clover grows well without liming.

The value of land of this type varies between $100 and $200 an acre.

BUCKNER LOAM

Buckner loam differs from Buckner silt loam chiefly in having a lighter textured and more variable surface soil, which is normally a friable loam. The type, as mapped, is variable and indefinite in spots; and several areas of the fine sandy loam are included with it, these being combined with the loam because of their small total extent.

Buckner loam is mapped on a rather large area south of Fetters, and in several smaller areas on the Wabash bottoms. This loam is all under cultivation and produces good yields of corn, wheat, and hay. The soil on the sandier areas is not quite so good, and it is more likely to dry out when the rainfall is scant.

The estimated price of land of this type is $100 an acre.

BUCKNER SILT LOAM

Cross sections of bodies of typical Buckner silt loam show the following (measurements being from the surface): From 0 to 10 inches, dark-brown friable silt loam; from 10 to 18 inches, dark-brown to almost black, heavy silt loam; from 18 to 28 inches, dark-brown mixed with yellowish-brown, heavy silt loam to clay loam; and from 28 to 36 inches, bright yellowish-brown fine sandy clay loam which becomes lighter and more open with depth. Variations in thickness and texture of the layers are found especially where this soil grades into adjoining types.

Buckner silt loam is mapped chiefly in the Wabash bottoms west of Patoka, Johnson, and Princeton, and in small areas near Skelton and Foots Pond. It occurs on the outer, higher, well-drained margins of old high bottoms and on alluvial fans.

Because of its favorable topography and freedom from ordinary overflows, this type is all cultivated and productive land. Corn, wheat, timothy and clover, and alfalfa are grown. Corn usually yields over 40 bushels per acre and wheat about 20 bushels. Yields of mixed hay average between 1 and 2 tons, and alfalfa, of which some small fields exist, gives three cuttings of 1 ton per acre each. Fertilizers are not generally used.

Prices of land of this type have been estimated to range from $100 to $150 an acre.

BUCKNER SILTY CLAY LOAM

Buckner silty clay loam, to varying depths of from 20 to 24 inches, is a dark grayish-brown silty clay loam (sometimes becoming slightly darker in the lower part before a rather abrupt change to subsoil), underlain by a brown to yellowish-brown, compact, silty clay loam subsoil. The lower part of the subsoil is brighter in color than the top portion, and it is well oxidized. The subsoil grades into yellowish-brown sand and fine gravel. In places this sandy substratum lies closer to the surface than commonly; so that the upper layers are thinner, are colored a lighter shade of brown, and are slightly lighter in texture. There are also small spots where the dark surface soil is unusually deep.

Buckner silty clay loam is mapped only as two large areas west of the Foots Pond Hills. These areas lie back some distance from the river channel, are relatively high, and are almost entirely surrounded by lower land including soils of the Genesee series. Along one edge they are marked by a rather distinct bank occupied by Elk soils, while on the other edge they grade into the Genesee silty clay loam. These areas are high enough to escape minor floods. The larger area has been protected by a low levee which prevents any extremely high water from sweeping directly across it. The underdrainage is good.

Although this type is of very small extent in Gibson County, it is all under cultivation. It forms islands in the bottoms where it is possible to have good, permanent improvements and to grow wheat, oats, and corn. Timothy and clover are also grown. The yields of the crops grown on this kind of land are higher than the general averages.

LYLES FINE SANDY LOAM

Lyles fine sandy loam has a top layer of dark-gray to dark brownish-gray fine sandy loam, which becomes slightly lighter and marked with rusty brown below 8 inches. At a depth of 24 or 30 inches the subsoil is a light-gray, rusty-brown, or yellowish-brown, sticky fine sandy loam. The texture of the soil varies from loamy fine sand to light loam, and the color and depth of surface soil have rather wide ranges.

This type is mapped in and along the belt of sandy lands southwest of Princeton and Owensville. Mapped areas include some dark sandy soil of recent alluvial origin, such as the dark sandy strip along a small stream bottom south of Johnson.

The topography is nearly flat to slightly sloping, and is interrupted a little by old channels. The surface drainage is fair; but the land is inclined to be wet, since it absorbs and holds moisture. Furthermore, it is doubtless kept wet by seepage from adjoining higher sandy lands.

The soil occupies a small total area, but is mostly cleared and used for the production of corn, hay, and pasture. Wheat and oats can be grown on the better-drained fields. Crop yields are generally good.

LYLES LOAM

Lyles loam consists of from 12 to 20 inches of black to dark-gray friable loam which grades downward through dark brownish-gray

loam into light brownish-gray or brown fine sandy clay loam. The soil varies in texture, tending in places toward a heavy fine sandy loam and in others toward a silt loam.

Except for texture, there is little difference between this soil and other types of the Lyles series. Origin, occurrence, drainage, use, and crop yields are much the same on all. The type is confined to several small areas on the bottoms northwest and southwest of Princeton.

LYLES SILT LOAM

Lyles silt loam consists of 9 or 10 inches of dark-gray, friable silt loam which grades downward into dark-gray silty clay loam, mottled with yellowish or rusty brown, and then, at about 18 inches, into a lighter gray or drab silty clay loam streaked with light gray and yellowish brown. This land in places is spotted with small patches of soil which are dark colored to a depth of 3 feet or more. Boundaries of type areas are seldom distinct, and the mapped areas may include patches of Sharkey soils and other types of the Lyles series.

Lyles silt loam is mapped as several large areas west and southwest of Princeton, on the edge of the Wabash bottoms. It occurs on flats or very gentle slopes intermediate in position between the higher Buckner and Elk soils, on one hand, and the lower Sharkey soils, on the other.

The naturally poor drainage has been improved by ditching; and at present the land can grow most crops and is seldom overflowed. Corn is the main crop, yielding 50 bushels or more per acre in average years. Wheat, timothy, and clover are also successfully grown on well-drained fields.

The value of this land ranges from $100 to $200 an acre.

ELK FINE SAND

Elk fine sand consists of a surface layer of light-brown or light grayish-brown fine sand or loamy fine sand, 3 to 6 inches deep, underlain by light yellowish-brown, loose fine sand which extends to depths of from 3 to 15 feet or more. There are in places slightly heavier, sticky layers at a depth of several feet. On some areas of rather shallow soil some faint grayish mottlings appear in the material just above the heavier stratum. A flat phase of this type occurs on the Posey County line. Here some dark-brown, soft iron concretions and mottlings of brownish gray and rusty brown begin to appear at a depth of about 18 inches. These characteristics probably owe their origin to the high water table.

The Elk fine sand is mapped as large bodies near Johnson, Princeton, and Patoka, and as smaller areas on the higher parts of the sandy islands of the Wabash high bottoms.

The topography of these areas ranges from smooth, slightly elevated, and flat to higher, dunelike knolls where the surface has been reworked by the wind. In the latter case, the type is hardly distinguishable from the Princeton fine sand. In fact, these two types are essentially the same in soil character to a considerable depth; and where they occur side by side, the boundary line was drawn where there appeared to be a physiographic change between terrace and uplands.

The Elk fine sand constitutes an important part of the specialized farming district in which cantaloupes and watermelons are grown on a commercial scale. The agricultural comments on the Princeton fine sand apply almost equally well to the Elk fine sand.

ELK FINE SANDY LOAM

The surface soil of Elk fine sandy loam consists of 10 or 12 inches of fine sandy loam or loamy fine sand, colored light grayish brown in the upper part and light yellowish brown in its lower part. The upper portion of the subsoil consists of light-grayish or yellowish-brown, heavy fine sandy loam, and the lower portion consists of a slightly darker and heavier loam. The parent material appears at a depth of about 30 inches, and consists of a light-brown fine sandy loam, slightly mottled with gray. The lower substrata consist of stratified sand and loamy material. At this depth there is little lime carbonate. A high water table is common on areas of this type.

The Elk fine sandy loam occurs as small areas scattered throughout the old high bottoms. It occupies the flatter and lower parts of sandy islands, and it is surrounded by lower areas of heavier types of soil. The surface drainage is fair, but in flood times the land may be partly covered with water. The underdrainage is poor to fair.

The original forest growth has largely been cleared away, and the land is devoted to the production of corn, hay, and small grains. The use of this soil for watermelon growing has increased since the discovery of the fact that it is better adapted to varieties like the Irish Gray than are the lighter sandy soils.

This type is not important in the county because of its small extent and unfavorable location on the "bottoms." It is valued at about $100 an acre.

ELK LOAM

The surface soil of Elk loam consists of a friable, light-brown or yellowish-brown loam, about 8 inches deep. The immediate surface layer is a little darker than below, owing to a larger content of organic matter. The texture is variable, ranging from fine-textured loam to heavy fine sandy loam. The subsoil is heavier, consisting either of light yellowish-brown heavy loam, or clay loam, containing much fine sand, or silty clay loam. A few grayish and brown mottlings are present in the subsoil. The parent material, encountered at depths of from 30 to 38 inches, consists of deep, light-textured, light yellowish-brown stratified materials. These underlying sediments are moderately calcareous. Acidity tests of the heavy subsoil layer indicate high acidity in some places.

Elk loam occurs in more than a dozen small areas south of the town of Fetters and east and west of Foots Pond Hills, occupying rises along or near the rim of the old high bottoms. It is fairly well drained on the surface, but the subsoil mottlings indicate that underdrainage is not everywhere good. The areas are overflowed only during times of very high floods.

This type, developed under a forest cover of oaks, hickory, black gum, elm, and other hardwoods, has been cleared and brought under cultivation. Corn, the leading crop, yields from 30 to 50 bushels per acre in normal years. Timothy and Sudan grass are grown for

hay; and less commonly, small grains. The type is comparatively unimportant in Gibson County because of its small extent. Its value is about $100 an acre.

ELK SILT LOAM

Elk silt loam has a light grayish-brown surface layer of silt loam which, with depth, becomes pale yellow, and in places slightly mottled with light gray. The subsoil consists of a rather compact, yellowish-brown silty clay loam, which grades downward into slightly lighter and more friable material. Soil such as this occurs as the better-drained natural levees along abandoned stream channels through the area of Calhoun silt loam along the Patoka River.

Other areas having soil features more typical of the Elk series occur as narrow strips on natural levees along old channels where the sediments have evidently come from the Wabash River, although the smooth silty texture may indicate that some alluvium had been deposited by the Patoka River. The friable surface soil has a brown color, which is suggestive of the Genesee soils, and it has a depth of about 10 inches.

The surface of the areas of Elk silt loam is flattish, having a rather distinct drop to a channel on one side and a more gentle slope to lower land on the other side. The surface drainage is fairly good. The areas lie high enough to escape all except the highest overflows.

Elk silt loam covers a very small part of the county. It is largely under cultivation, being devoted to the production of corn and hay. Land of this type is valued at about $100 an acre.

M'GARY SILT LOAM

A cross section of a body of typical McGary silt loam, under virgin conditions, exhibits the following characteristics: A surface 4-inch layer of grayish-brown silt loam containing some organic matter, and faintly mottled with light gray; a subsurface layer of very light-gray, friable silt loam, slightly mottled with brown; a heavier subsoil, beginning at a depth of about 12 inches, of light-gray silty clay loam, mottled with yellowish brown and brown, and grading downward into silty clay; and a lower substratum, beginning at a depth of about 32 inches, consisting of a light-yellow, friable, calcareous, silty clay loam or silt loam, faintly mottled with light gray and brown. This latter material probably extends 10 feet or more downward, and the lower substrata are deep lacustrine sediments. In places large irregular lime concretions are found in the upper portion of the parent material, immediately below the subsoil.

McGary silt loam has developed on all of the old glacial-lake flats occurring in the central belt which extends north and south across the county. In the somewhat dissected flat 5 miles south of Owensville this type comprises a large proportion of the land; but on the other plains, dark soils usually predominate. In mapped areas of McGary silt loam are included strips of better drained and oxidized soils which look like Owensville silt loam, small eroded patches, and other patches showing differences due to blending of this type with surrounding soils. A lighter phase of this type occurs in the plain

several miles east of Patoka, where the texture of the surface soil approaches a very fine sandy loam or fine-textured loam.

The topography is nearly flat and quite smooth, but the surface of these areas is slightly higher than that of surrounding types. In some cases this soil occurs on long gentle slopes. In the virgin condition, water had been held on the surface by forest litter and tree roots; but since most of this land is now cleared, the excess rainfall runs off fairly rapidly onto lower land or into shallow, V-shaped "draws" which extend into the lake plains in places. The underdrainage is poor, and the land stays wet in the spring. On the other hand, when the land becomes dry there is need of timely rains to supply moisture for the crops, the roots of which have become established in the rather shallow friable surface layers. Tile drains have been installed in some fields to improve the drainage.

McGary silt loam is a fairly extensive and important type of soil. It is practically all under cultivation. It is used for the production of corn, wheat, oats, timothy, clover, and tomatoes. Clover and corn are not very successful on this type, but small grains and hay do well. Yields are variable on the areas as mapped, because of the included patches of other soils. For instance, in places very unproductive "white spots" occur, and elsewhere the crops may yield almost as well as on dark land.

The surface soil and subsoil of this type are very acid, and lime has been used with good results in growing legume crops. Acid phosphate and mixed commercial fertilizers containing a little soluble nitrogen and potash, in addition to larger quantities of phosphoric acid, are applied to the wheat crop.

The value of land of this type is probably higher than that of other gray lands because of its association with better soils.

TYLER SANDY LOAM

Tyler sandy loam consists of gray or brownish-gray, heavy sandy loam, from 10 to 20 inches deep, overlying a deep light-gray or light-brown sandy clay loam. The surface layer varies, being either finer or coarser in texture than typical, and having different shades of color.

This type is mapped on a few small areas occupying slight rises in the old high bottoms of the Wabash. Here these areas are surrounded by heavier soils of the Tyler and Sharkey series. The relief is insufficient to prevent overflow during high floods. Because of their elevation and the texture of the soil, these areas drain better than the surrounding land, and hence are used for building sites, gardens, and for the production of corn and other minor crops. Corn, the main crop, yields ordinarily from 30 to 50 bushels per acre. There are some "thin spots" on the type areas that do not yield quite so well as this.

TYLER LOAM

Tyler loam is a medium or sticky, gray sandy loam, underlain at a depth of about 8 inches by a lighter-gray loam or sandy clay loam, highly mottled with rusty and yellowish-brown colors. The deeper substratum consists of heavier materials resting on fine, water-bearing gravel.

This type is mapped on a few scattered areas on the old high "bottoms." These areas represent transitional zones between Sharkey soils and the higher, sandy land.

The topography is smooth and flat, hence surface drainage is naturally slow. This land is seldom overflowed; but since it absorbs and holds moisture it is rather wet. It is used for the production of corn, hay, and, to some extent, small grains. It is not so productive as most of the bottom soils.

Tyler loam, brown phase.—The brown phase of Tyler loam differs from the brown phase of Tyler clay loam chiefly in texture. Statements made in regard to the latter soil apply to the brown loam also. This brown loam was mapped as several small areas west of Skelton.

TYLER CLAY LOAM

Tyler clay loam consists of 7 or 8 inches of medium, gray or drab clay loam underlain by clay loam colored a lighter gray or drab and somewhat mottled with rusty and yellowish-brown colors. In some places there is present a layer in which hard ferruginous materials appear; but distinct concretions, such as occur in some other soils, are rarely present. At depths of from 10 to 20 feet the subsoil is underlain by beds of fine gravel. Type areas as mapped include spots of silty clay loam, or sandy clay loam, and soils having lighter or darker shades of color. The boundaries of the type are seldom distinct, since this soil grades into adjoining soils.

Tyler clay loam, occurring only on the Wabash bottoms, is mapped as a chain of areas bounded by areas of Sharkey clay on one side and of higher soils on the other.

The surface is very smooth and flat or slopes very gradually away from the river toward the hills. The surface drainage is slow, and, although dredged ditches have rendered it fit for cultivation, the roads and fields on this type become very muddy at times. The subsoil is too heavy for rapid movement of soil moisture, and the substratum is usually water bearing.

Tyler clay loam is the most extensive type of the Tyler series mapped in Gibson County. It is a fairly important type on the high bottoms. It was formerly heavily timbered; but most of the land has been cleared, and is now cultivated. Corn, the main crop, yields a little less than on the darker lands. The land is also sown in oats and sometimes in wheat, which yield fair crops in favorable seasons. Timothy, cowpeas, and Sudan grass are grown as hay crops, with good results.

Tyler clay loam, brown phase.—As the name implies, the brown phase of the Tyler clay loam has been separated from the typical Tyler clay loam on the basis of color, shades of brown displacing the typical grays to greater or less extent. This color difference is normally accompanied by better surface drainage and underdrainage, by a slightly lighter texture, and by a slightly more advanced stage of soil weathering. This brown-phase soil is considered somewhat better land for general farming than the grayer Tyler clay loam. In some places this phase might be considered as a darker phase of Elk clay loam. It occurs mostly, as several areas, near Skelton, sharing the outer margin of the old high bottoms with

the Elk soils. Possibly the brown color is due, not merely to better drainage and aeration, but also to overwash of recent sediments, such as those forming the Genesee soils.

The surface of these areas is usually smooth and nearly flat. In places it drops off to a channel on one side; and on the other blends gradually into lower lands. The drainage is fair, but a distinctly mottled subsoil indicates a rather sluggish movement of soil moisture. Overflows by the river are only occasional. These have caused some erosion of the surface.

This phase is of small extent, but it is counted among the better soils included in the Tyler series. It is used for the production of corn, wheat, oats, and timothy, with very good results. Crops are seldom injured by overflows. This land is valued at more than $100 an acre.

Tyler clay loam, heavy phase.—The heavy phase of Tyler clay loam is really Tyler clay, but it is mapped as a heavy phase because of its small total extent. It also resembles Sharkey clay; but its surface color is of a lighter shade than that of the Sharkey soil and the subsoil is more strongly mottled. It lies at slightly higher elevations on the old high bottoms, and has better surface drainage than the Sharkey clay. Only a few small areas are mapped, these lying along the Posey County line south of Foots Pond.

Corn has been grown on this soil seemingly with as good results as on lower land.

CALHOUN SILT LOAM

The surface soil of Calhoun silt loam consists of a top layer of light-gray, friable silt loam, about 6 inches deep, underlain by a light-gray friable silt loam or silty clay loam, more or less mottled with yellow and brown. The subsoil to depths of from 14 to 24 inches, consists of a compact, plastic clay mottled with light gray, yellowish brown, and brown. In virgin areas the upper layer, 1 or 2 inches thick, is slightly darker than the material below, owing to an admixture of organic matter. When wet the surface color is brownish gray. When dry, plowed fields assume a light color almost white. The subsoil in places is spotted with almost white, incoherent silt, and with yellowish lenses of a more plastic material.

Practically all this type occurs near the course of the Patoka River through the Wabash bottoms. The areas are large, some extending for several miles without interruption. The surface of the land is flat and smooth, with few of the inequalities commonly found on river bottoms. The surface drainage is naturally rather poor, and the heavy subsoil prevents rapid internal movement of moisture. Nevertheless, the land becomes dry enough for farming when it is artificially drained. Most of the original forest growth of oak, hickory, elm, ash, gum, and other hardwoods has been cut off. The principal crops are corn, wheat, timothy, and oats. The soil is not so well adapted to corn as the darker bottom lands, and the yields are lower. However, it produces very good crops of small grains and hay. Reported yields per acre are: corn, from 30 to 40 bushels; and wheat, from 20 to 30 bushels. Alsike clover is used to some extent for seeding this land, and it does better than the red clover.

The value of Calhoun silt loam is considered somewhat less than that of the darker bottom lands.

CALHOUN CLAY LOAM

The surface soil of Calhoun clay loam is a light brownish-gray or gray clay loam or sandy clay loam, 6 or 8 inches deep, overlying a subsurface layer of light-gray sandy clay loam more or less mottled with yellowish brown. Below this surface soil, to a depth of about 20 inches, is a subsoil varying from a more compact sandy clay loam to sandy clay. The substratum is similar to the subsoil in the upper part and includes sandy and gravel layers at lower depths.

This type is mapped on the old high bottoms west of Patoka and Princeton as a transitional type between Calhoun silt loam and the heavier and darker soils. Mapped areas include, therefore, some textural and color variations. It is distinguished from the surrounding soils by its very light color and its sandy, yet sticky and heavy texture.

A part of this type is still forested; the remainder is used like the other Calhoun types, to which it corresponds in most respects.

CALHOUN SILTY CLAY LOAM

Calhoun silty clay loam may consist of a top layer of very light gray or grayish-brown, friable silty clay loam, 6 or 8 inches thick, resting on light-gray, semiplastic, silty clay loam or silty clay, more or less mottled with yellow and brown. This sublayer extends to a depth of several feet without change.

Most of this type is mapped as one large area on the old high bottoms west of Princeton, where it has apparently developed from sediments containing a little less of the smooth silty material from the Patoka River and more of the heavier material from the Wabash River overflows. It is a little more variable than the Calhoun silt loam—since there are minor inclusions of patches of associated types—but aside from texture the two soils are much alike. The silty clay loam may include a little more uncleared land than the silt loam. In use, adaptation, and crop yields they rank the same.

ROBERTSVILLE SILT LOAM

The surface soil of Robertsville silt loam consists of friable silt loam ranging from 8 to 16 inches in thickness, averaging nearer the shallower depth. The upper 3-inch or 4-inch layer, under virgin conditions or in plowed fields, is light brownish gray, and the subsurface layer is colored a very light gray and is faintly mottled with shades of gray and brown. When wet the surface has a darker shade, and when dry it is light ashy gray or almost white. A few black iron concretions are found in the soil. The subsoil grades first into silty clay loam and then into a tough, plastic silty clay mottled with yellowish brown, light gray, and dark rusty brown. Below 36 inches the subsoil is underlain by a slightly lighter and more friable material.

Robertsville silt loam is found on the outwash plain east of the line between Princeton and Haubstadt, where it is associated with the Waverly and Robinson silt loams. It also occurs on the low benches of Pigeon Creek and its tributaries, where marginal lake sediments have been deposited.

The topography of the Robertsville silt loam is very smooth and level. Areas of this land often blend into adjoining higher and lower land without any sharp change of slope or striking soil differences. The surface drainage is naturally slow. On cleared land the run-off to lower lands is fairly rapid; but the water which penetrates the soil is held by the impervious subsoil, and even tile drains do not remove it very rapidly unless placed close together.

The Robertsville silt loam is rather important in Gibson County because of its extent and favorable topography, although it is less productive than many other soils. It is acid in the surface and more so in the subsoil. It is too cold and wet to be favorable for clover and corn. Wheat is the best grain crop, yielding over 20 bushels per acre in favorable seasons. Timothy, redtop, and alsike clover are used as hay crops. Some of this type has been limed in recent years, with good results, as indicated by legumes and succeeding crops. Phosphatic fertilizers are used with wheat.

The value of Robertsville silt loam ranges between $50 and $100 an acre.

ROBINSON SILT LOAM

Robinson silt loam consists of several inches of light brownish-gray, friable silt loam, faintly speckled with brown, underlain, to a depth of about 36 inches, with a very light gray, friable silt loam, slightly mottled with yellowish brown and brown. There may be slightly sticky or heavier lenses in the lower layer. A well-defined heavier layer is found below a depth of 3 feet. Where the heavy subsoil occurs at shallower depths, the soil is really Robertsville silt loam. The Robinson silt loam is not sharply defined and hence it merges into the Robertsville silt loam and the Haubstadt silt loam.

The surface of Robinson silt loam is flat, and rainfall runs off slowly into the neighboring draws. Much water is absorbed and held in the deep silty surface soil, making the land cold and late. The soil is more resistant to drought than soils which have heavy subsoils closer to the surface.

This type is mapped in several areas southeast of Princeton and down the valley of Pigeon Creek. Although it originally supported a good growth of forest, the land is now mostly under cultivation. Corn and wheat are the main crops. Timothy and redtop hay is also grown. Corn is often late and unpromising in the spring, but in average seasons it makes rapid growth in the summer, and yields from 30 to 50 bushels per acre. Wheat yields from 15 to 25 bushels; and hay, more than 1 ton per acre. Acid phosphate is commonly used on wheat. Recently some land of this type has been limed, making possible the successful growing of clover. The value of this kind of land depends on location, improvements, and associated soils.

HAUBSTADT SILT LOAM

The top layer of Haubstadt silt-loam, about 8 inches deep, consists of light-brown, grayish-brown, or yellowish-brown friable silt loam, being slightly darker in the surface few inches. This top layer grades into a subsoil consisting of light yellowish-brown, friable yet compact, silty clay loam, about 28 inches thick. The material below the subsoil is a little less compact than the subsoil itself. This substratum

in turn grades into stratified silt and sand, which may be nearly 100 feet thick over bedrock. In places, as on some of the more sloping margins of the outwash plains, this type resembles the Bainbridge silt loam. In other places this type grades into such types as Robertsville silt loam, Robinson silt loam, and Montgomery silt loam. Where it borders bodies of Gibson silt loam the boundary on the map is drawn largely according to the topography.

Haubstadt silt loam is almost like Gibson silt loam, except that the lower layers of the former consist of stratified silt and sand. This type has apparently developed through the partial erosion of flats on which the original soils were grayish in color and poorly drained. The subsoil may be a little more mottled than in the Gibson silt loam; and as mapped, type areas may include patches of Robinson, Robertsville, and Bainbridge soils.

This type occurs as an important and extensive soil on the belt of outwash plains between Haubstadt and Francisco, where it occupies the more or less dissected outer margins of the Sand and Pigeon Creeks valleys. The topography is like that of Gibson silt loam, but the average relief is milder and the small surface drains are shallower and less numerous. Most of this type is under cultivation, corn, wheat, and timothy being the leading crops. Crop yields compare favorably with those on Gibson silt loam.

BAINBRIDGE SILT LOAM

Bainbridge silt loam is characterized by a 10-inch surface layer of moderately dark-brown, friable silt loam, underlain by a 5-inch layer of yellowish-brown, friable silt loam; and by a subsoil consisting of well-oxidized, yellowish-brown silty clay loam, in places almost reddish brown in color. At depths of from 4 to 6 feet below the surface the subsoil may grade into red, sandy to gravelly clay loam or other stratified, outwash deposits. So far as they have been observed, the materials below the subsoil are not calcareous, and the color is a shade of red characteristic of the lighter-textured Illinoian deposits found throughout southern Indiana. This porous outwash material is supposed to underlie a number of other types of soil, but in those types underdrainage is checked by a hardpan layer and the thick heavy-textured overburden. On the area of Bainbridge silt loam, however, the porous substratum material seems to be nearer the surface than in other types, and drainage is afforded by the adjacent, lower-lying stream bottom.

This type occurs only in one large area near Port Gibson. The topography is very flat. There are a few minor undulations and some faint draws which lead to the adjacent lowlands. Along the rim of this area is a sharp escarpment 15 to 20 feet high. Physiographically, the area is part of a large outwash plain. Its surface drainage is fair to good, and its underdrainage is favored by the deep, porous substratum.

Bainbridge silt loam is of small extent in Gibson County, but it is more extensive in Dubois and Pike Counties. All of it in this county is under cultivation as general-farming land. Some phosphatic fertilizers are used on wheat and corn. The native vegetation consisted of a forest of hardwood. The land is valued at more than $100 an acre.

LINTONIA SILT LOAM

The surface soil of Lintonia silt loam consists of about 10 inches of light-brown, very friable silt loam overlying a slightly lighter brown or grayish-brown silt loam. Below this, beginning at a depth of 2 feet, is a light-brown, slightly more compact yet friable silt loam which, in many places, extends to a depth of 10 feet.

This type is developed as several small strips along the foot of the river bluffs between Hazelton and Johnson. The surface normally slopes gently away from the hills. Their upper margins are sharply separated from the hill types, whereas the lower margins blend with the adjacent bottom soils. The total area of this type of soil is small. A darker variation is included in the flatter part of the area mapped near the entry of Indian Camp Creek into the Wabash bottoms.

This type is used for corn, wheat, timothy, and red clover, all producing excellent yields. The value of this land is more than $100 an acre.

Lintonia silt loam, light phase.—The light phase of Lintonia silt loam represents areas of Lintonia silt loam which include patches of fine sandy loam. This is done to avoid the use of an extra color on the map. It occurs as small areas near Johnson and the Foots Pond Hills. The uplands from which the parent sediments have been washed are more or less sandy. Aside from texture and the resulting adaptation to melon growing, this phase differs but little from the silt loam.

GENESEE FINE SANDY LOAM

Genesee fine sandy loam is the most variable soil of the Genesee series mapped in Gibson County, since it was mapped to include all Genesee soils coarser in texture than silt loam, including gravel, sand, and very fine sandy loam. The color tends to be a lighter and clearer brown than that of the heavier types, and the content of organic matter is lower. The soil commonly effervesces with acid, partly as the result of the presence of numerous shell fragments.

This type is confined to the natural levee areas or to the banks of the Wabash and White Rivers, and it occupies the level areas immediately above the willow flats. In places an area of such soil may be widest on the inside of an oxbow curve where the swift currents, flowing out of the channel during high water, drop their coarser sediments. The river bank is commonly fringed with such trees as willow, sycamore, cottonwood, and soft maple, and tall weeds. These check the currents, so that most of the sands are dropped within a few hundred yards of the bank. This natural levee, being about the last part of the recent bottoms to be flooded, is used as the site of farmhouses. The houses are usually set on posts several feet above the surface.

This type is inextensive and unimportant, except in its value as sites for farmsteads. Though freshly deposited sand renders some of this type temporarily unproductive, the soil soon recovers and yields practically as good corn as heavier types of soil. The crop is less likely to be lost or damaged by floods than in the lower parts of

the bottoms. This is practically the only sandy type of soil in the county that has not been used for commercial melon growing.

GENESEE SILT LOAM

Genesee silt loam consists of an 8-inch top layer of brown, friable silt loam overlying a thick layer of chocolate-brown, friable silt loam or silty clay loam. The deeper substrata consist of variable layers of brown, moderately calcareous silt and sand.

This type is predominant along the White River, just as the Genesee silty clay loam is along the Wabash. Where they occur side by side the silt loam is usually found at a slightly higher elevation, or at least nearer to some channel than the heavier soil. The topography and drainage of the two types are much the same. The silt loam is less subject to overflows, but it is more likely to wash when it is flooded. It is more variable in texture, and more friable, and a little easier to cultivate than the silty clay loam. Corn is the chief crop.

GENESEE SILTY CLAY LOAM

Genesee silty clay loam is characterized by a top 6-inch or 8-inch layer of friable, dull chocolate-brown silty clay loam, and by a deep subsurface layer of silty clay loam, lighter brown in color and slightly more compact or heavier than the top layer. This type is very uniform in color and texture. It is the dominant soil of the recent flood plains of the Wabash River.

This type normally occurs back from the open channels, and it does not touch the river except where the outside bends of great oxbows are cutting back into the bottoms. The sediments from which the soil is formed have been laid down in the more quiet backwaters, they being the finer silt and clay which require quiet waters for sedimentation. This process has resulted in a uniform, deep, heavy soil.

Genesee silty clay loam is well drained; but since it is the lowest lying of the Genesse types, it is the first to be submerged in times of high water. Because it lies back from the swift currents of the open channel and is protected by trees and other vegetation, it is seldom eroded by the floods. It also suffers less change by the addition of fresh sediments, since here they are laid down a little at a time.

The surface of this type is generally smooth, though it offers considerable contrast to the old, flat, high bottoms in its many minor irregularities owing to partly filled and abandoned stream channels. Where old oxbows occur, there may be parallel ridges and swales with differences in relief of from 5 to 10 feet.

Genesee silty clay loam is one of the more extensive types found on the stream bottoms of Gibson County, and it is naturally one of the most productive soils in the county and State. Most of it is now under cultivation, except narrow timbered belts along old river channels. Corn is practically the only important crop, because the danger of overflow makes the growing of small grains or clover inadvisable. The records show that land of this type will produce from 40 to 70 bushels of corn per acre for many years before the

yields decline. Recently Sudan grass has been tried. It gives two or three heavy cuttings of hay in one season. No fertilizers are used.

Because of its location on the overflowed bottoms, few buildings are to be found on this type. Its selling price varies greatly according to accessibility and the degree to which it is subject to flooding. A few feet difference in elevation may make much difference in the damage suffered by crops during high water.

Genesee silty clay loam, poorly drained phase.—The poorly drained phase of the Genesee silty clay loam occupies the bottoms of abandoned stream channels, which are being filled with sediments. It is a variable soil having the characteristic brown color of the Genesee series. The top soil varies in depth from 10 to 20 inches. Underlying this top soil is a mottled light-gray and brown silty clay loam. The deeper substrata consist of materials ranging from sand to a heavy drab-colored clay.

The topography of this phase is flat and depressed. The type occupies long narrow areas in which water often stands until it evaporates or seeps slowly away. Some of it has been under water or in marsh or swamp, supporting a growth of water-loving brush and some scattering elm, maple, ash, and gum trees. None of it is used for farming at present.

SHARKEY CLAY LOAM

The surface soil of Sharkey clay loam consists of an 8-inch layer of dark-gray or drab sandy clay loam, underlain by a layer of dark-drab sandy clay, speckled with rusty brown. At a depth of 28 inches the deeper material becomes lighter drab in color and is speckled with rusty brown and yellowish brown. The soil seems quite sandy when in good tilth; but it is sticky when wet, and clods badly when plowed in a wet condition and allowed to dry. It is thought that an unusually high colloidal content gives the type the characteristics of a very heavy soil.

This type is mapped in a number of areas on the old high bottoms of the Wabash River. It is developed along the belt of Sharkey clay, and in most places it represents a transition zone between the clay and some higher sandy type. The surface is smooth and the natural drainage is probably a little better than on the clay. The type is now artificially drained, so that corn, hay, and small acreages of other crops are successfully grown. The yields approximate those produced on Sharkey clay. The clay loam is a little easier to handle than the clay, because of its sandier surface soil. Fertilizers are not used to any extent.

Sharkey clay loam is not found extensively in Gibson County. It is a good productive soil.

SHARKEY SILTY CLAY LOAM

Sharkey silty clay loam is characterized by an 8-inch layer of dark-gray silty clay loam overlying a layer of dark-gray or drab clay loam or silty clay. At a depth of about 20 inches the material assumes lighter shades of gray and is speckled with rusty brown.

Deeper down are water-bearing gravels. Apparently the type is a transitional soil, developed where more friable silts (much like the Genesee materials) have covered old Sharkey soils, although the occurrence of the areas does not always bear this out.

Sharkey silty clay loam is mapped as several distinct areas scattered along the western border of the old high bottoms. The surface is usually smooth and flat, but shows more inequalities than the other Sharkey types, probably due to recent overflows. The drainage, too, is naturally a little better, and the land is easier to cultivate. Corn is the principal crop, yielding from 40 to 60 bushels per acre in normal seasons.

The value of this kind of land probably averages more than $100 an acre.

SHARKEY CLAY

Sharkey clay is distinguished by a surface layer of plastic, intractable clay, dark gray or drab in color, and in places slightly speckled with rusty brown. This top soil usually contains noticeable proportions of sand and fine gravel throughout the 3-foot section. The subsoil consists of a lighter drab or light-gray, heavy clay more or less mottled with rusty and yellowish-brown colors. The substratum, appearing at depths varying from 10 to 15 feet below the surface, is composed of fine, water-bearing gravels, including a small proportion of limestone.

The principal variations of this type occur where it grades into other types of the Sharkey series and into soils of the Tyler, Buckner, and Elk series. The boundaries of the areas are seldom sharply defined.

Sharkey clay is mapped as a large area in the western part of the county, and also as several smaller near-by areas. It occupies the main backwater area of the old high bottoms, just west of the bluffs. This soil also occurs in Posey County, where it has been mapped as Griffin clay in the soil survey of that area made in 1901.

The topography is naturally flat and depressed, so that originally the drainage was very poor. Even with artificial drainage, the land may be flooded with several feet of water for weeks at a time by waters from the Wabash River. This usually occurs in the winter, but within recent years some overflows have occurred at times when the corn crops were still in the fields. Several large dredged ditches carry the waters of upland streams across this land. They carry off surface water rapidly when the river is low. It is this drainage that has made Sharkey clay fit for cultivation. The soil does not become soft or "boggy" when saturated with water, although the surface may be too slick and sticky for travel or cultivation. As the land dries out there are a few days when the moisture conditions render the soil rather easy to work, but it soon becomes too hard to plow. When the land is plowed under too wet conditions clods may form and remain all summer. These clods break down only under the alternating freezing and thawing during the following winter.

Sharkey clay is a rather extensive and important type of soil in Gibson County. It formerly supported a heavy forest growth. This has been removed and the land has since been devoted to the produc-

tion of corn almost continuously. Although the land is often so wet that great difficulty is experienced in planting, corn makes a wonderful growth, and yields 40, 60, or 80 bushels per acre. In addition to the difficulty experienced in planting corn, further difficulties are experienced in harvesting the crop during wet seasons. In some seasons it is necessary to store the grain in cribs and carry it over until the next season, owing to the difficulty of hauling when the roads are wet. Weeds are a problem on this land, as they are on other bottom-land soils. Trumpet vine and morning glory grow luxuriantly, compelling the use of disk cultivators. Cowpeas may be grown with good results. Sudan grass makes a heavy growth and it may be cut several times a year.

Sharkey clay, mucky phase.—The mucky phase of the Sharkey clay includes areas which are transitional between the typical Sharkey clay and Muck. This kind of land varies from shallow Muck over drab-colored clay to a darker clay containing more organic matter than Sharkey clay.

The mucky soil may be found adjacent to the two areas of Muck lying along the eastern margin of the Wabash bottoms. The topography is flat and depressed. The drainage was very poor prior to the construction of large dredged ditches which now very effectually remove all excess water. The land is easier to cultivate than the typical Sharkey clay, and it gives high yields of corn and hay. The land is valued at $100 or more an acre.

Sharkey clay, poorly drained phase.—The poorly drained phase of Sharkey clay is characterized by a surface layer of heavy silty clay loam or silty clay, drab to dark drab in color and slightly speckled with rusty brown. At a depth of about 12 inches, the surface soil grades into a drab-colored plastic clay or silty clay, slightly mottled with rusty brown.

This soil is found only in old river channels, doubtless abandoned by the Wabash River in comparatively recent times. It is forested with large ash, elm, maple, gum, sycamore, and other trees. Practically none of this phase is used for farming, since the surface is not only flat, but is depressed to the extent that water covers it deeply and for long periods. The land is used chiefly as a source of lumber and firewood.

HUNTINGTON SILT LOAM, SHALLOW PHASE

Huntington silt loam, shallow phase, is a light-brown, friable silt loam or loam, 8 to 36 inches deep, overlying a darker-colored clay loam, silt loam, or clay. In places the surface soil is mottled with light gray.

This phase represents alluvium which, for the most part, has been washed from the upland since it has been cleared, and which has been deposited over dark-colored bottom soils.

It is the dominating alluvial soil along the stream bluffs below the Princeton and Owensville soils. These areas of soil extend into the Wabash bottoms, along dredged ditches. The surface is nearly level, and the drainage is fair. The areas are subject to overflow.

Corn is the chief crop grown, yielding 50 bushels or more per acre in average years.

HOLLY SILT LOAM

Holly silt loam is a light-brown or grayish-brown friable silt loam 10 or 12 inches thick, underlain by a light-gray, grayish-brown, or yellowish-brown, friable silt loam. Owing to varying conditions under which the parent materials have been deposited, there may be some variations in color and texture in the lower subsoil; but as yet no definite distinguishing characteristics have developed.

Areas of Holly silt loam occur along the Patoka River and the numerous streams of the nonlimy uplands in the eastern half of the county. In the Patoka River and Pigeon Creek bottoms the type occupies the better-drained land near the channels. It also occurs on the smaller bottoms near the heads of streams where silt, washed from the hills, doubtless imparts a brown color to the surface soil. Near the mouth of the Patoka River this soil is modified by Wabash River sediments.

The surface of the Holly silt loam areas is very smooth and level, and in many places the type is not sharply separated from the soils of adjacent terraces and uplands, into which it blends. Elsewhere the streams have undercut the highland and the edges of areas of Holly soil are marked by bluffs. The surface drainage is fair, these areas having the best surface drainage of any bottom lands. The land is sometimes overflowed several feet deep, though seldom during the growing season. Corn is the most important crop on this type. The yield probably averages over 40 bushels per acre. Hay crops yield well, and in the better-drained fields wheat is fairly successful.

The value of Holly silt loam ranges from about $60 to $100 or more an acre, depending on location and improvements.

WAVERLY SILT LOAM

Waverly silt loam is a friable, light-gray or brownish-gray silt loam, 3 or 4 inches deep, underlain by a deep subsoil of very light gray, friable silt loam, mottled with rusty brown. In places a compact or slightly cemented layer occurs at a depth of 5 or 6 feet below the surface.

This type was naturally poorly drained, owing to its flat surface, low position, and distance from stream channels. Deeply dredged ditches have transformed this land into fairly well-drained land with good outlets for tile. Crawfish holes are numerous on this land. Ditch banks reveal many ancient holes 10 feet deep lined with iron-ore casts and filled with darker soil.

Most of the Waverly silt loam is mapped along Pigeon Creek and its branches, and along other streams in the eastern part of the county. Some of this land is still covered with native forest, but most of it has been cleared. This is used for the production of corn, hay, and pasturage. In the better-drained areas, or during comparatively dry seasons, the crops on this type surpass those on most of the near-by uplands. The average value of the land is between $50 and $100 an acre.

MUCK

Muck, as mapped in Gibson County, is a mixture of more or less decomposed plant remains with silt and sand which have been washed and blown into poorly drained areas. Organic matter is the dominant constituent, and the material is black and structureless to a depth of 30 or 36 inches. Below this there is more or less brown, fibrous peat, resting on grayish sandy material containing some shell fragments or marly material. Two small areas are mapped, both on the Wabash bottoms.

The areas have been artificially drained, but it is still a problem to obtain adequate outlets for the cold spring water that seeps into the land. The larger area is used for the production of corn, and it is said to yield from 60 to 80 bushels per acre. The smaller area is used for trucking, producing a variety of vegetables. The value of land of the Muck type is high.

SUMMARY

Gibson County is an irregular area of 495 square miles in the southwestern corner of Indiana. It lies in the "Wabash Lowland Region." About one-fourth of the area consists of bottom land, a smaller proportion is glacial-lake and outwash plains, and the rest consists of gently to steeply rolling uplands, lying at elevations between 400 and 650 feet above sea level.

The bottoms are more or less subject to overflow and are poorly drained; the uplands are well drained by a network of streams.

Princeton, with a population of 7,132, is the county seat.

The climate is moderately cool, humid, and generally favorable for agriculture.

General farming is the prevailing type of agriculture, with corn, wheat, and hay as the main crops. Some special crops are grown. This is one of the important melon-producing sections of the country.

The upland soils have developed chiefly from the weathering of rather uniform, fine-textured materials, under a forest cover, and in a humid, temperate climate. These soils are light colored. Their surface soils are lighter in texture than their subsoils. The soils are grouped into series according to the degree of weathering as conditioned by topography, and the nature of the parent materials.

A belt of upland near the river bluffs, modified by loessial deposits, has given rise to more sandy types, with higher lime content and some dark-colored soils.

The Wabash bottoms contain sediments ranging in texture from sand to heavy clay; in reaction, from acid to calcareous; and in color, from light to dark. Under varying conditions these deposits have given rise to a number of different groups of soils.

The soils of the county may be classed in four main groups, according to the conditions under which they have developed, namely: (1) Well-drained soils; (2) water-saturated soils; (3) alternately aerated and saturated soils; and (4) alluvial soils. In each case differences in the nature of the parent materials, in the content of organic matter in the surface layers, and in drainage and differences in texture, etc., are the points which determine different types and series of soils.

The Buckner soils are the dark-brown, well-drained, productive soils of the Wabash second bottoms.

The Genesee soils are the brown, well-drained soils on the first bottoms of the Wabash and White Rivers. They are well supplied with lime and plant nutrients, and hence they are productive.

The Princeton soils are well drained, rolling, upland soils, locally called "red clay" lands. They include some of the better uplands.

The Owensville soils lie on slopes below the Princeton types, and are unusually well adapted to alfalfa.

The Elk series includes the light-colored and better-drained soils of the high bottoms. The sandy types of this series are used for the production of melons.

The Tilsit series includes the aerated, light-colored soils formed from sandstone and shale. These soils are acid, and, naturally, they are not so productive as many other soils of the county.

The Gibson soils resemble the Tilsit soils. The former have developed from Illinoian drift, and they include somewhat smoother and better lands.

The Haubstadt soils are terrace equivalents of the Gibson soils.

The Vigo soils are light-gray upland soils derived from old drift.

Two small areas of Muck have developed on the Wabash bottoms.

The Montgomery series includes the moderately dark, productive soils of old lake flats.

The Sharkey types are dark-drab soils having a high content of colloidal clay.

The Tyler types include the gray to brown soils, with mottled subsoils, intermediate in position between the Sharkey and Calhoun soils or between the Sharkey and Elk types.

The Calhoun series includes the very light colored soils of the old high bottoms.

The McGary soils include the light-colored and higher soils associated with the dark soils of the Montgomery series. They have heavy, yellow subsoils underlain by friable, calcareous material.

The Robertsville soils, like those of the McGary series, occur on lake plains, but they differ from the latter soils, in that they lack lime carbonates in the lower layers.

The Robinson soils resemble those of the Robertsville series, except that they have much deeper and more thoroughly leached surface layers.

The Lintonia soils of Gibson County constitute the brown, productive bench lands.

The Holly soils, alluvial in origin, are grayish brown in color, having mottled subsoils.

The Waverly soils are the lightest-colored soils of the first bottoms. They are naturally wet and acid.

The Bainbridge series includes those terrace soils which are locally known as "red sandy land."

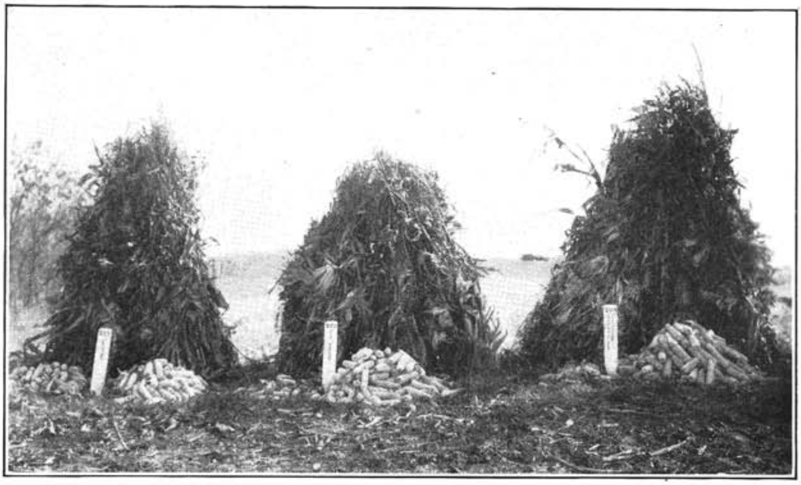

FIG. 1.—EFFECT OF LIME AND PHOSPHATE ON CORN YIELDS ON TILSIT SILT LOAM

From left to right: First, yield after legume only; second, yield after legume and lime; third, yield after legume, lime, and phosphate

FIG. 2.—EFFECT OF LEGUMES ON CORN YIELDS ON TILSIT SILT LOAM

From left to right. First, yield after lime and timothy; second, yield after lime and legumes

PART II. THE MANAGEMENT OF GIBSON COUNTY SOILS

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INTRODUCTION

The farmer must know his soils and have a sound basis for every step in their management. Building up the productivity of a soil to a high level in a profitible way and then maintaining it is an achievement for which every farmer should strive. The business of farming should be conducted as intelligently and as carefully as any manufacturing business. Every process must be understood and regulated, from the raw material to the finished product, in order that they may be uniformly successful. The farmer's factory is his farm. Different soils present different problems. It is important, therefore, that soils be studied and understood in order that crops may be produced in the most satisfactory and profitable way.

It is the purpose of the following discussion to call attention to the deficiencies of the several soil types of Gibson County, and to outline in a general way the treatments most needed and most likely to yield satisfactory results. No system of soil management can be satisfactory that does not, in the long run, produce profitable returns. Some soil treatments and methods of management may be profitable for a time but ruinous in the end. One-sided or unbalanced soil treatments have been altogether too common in the history of farming in this country. A properly balanced system of treatment will make almost any soil profitably productive.

CHEMICAL COMPOSITION OF GIBSON COUNTY SOILS

The following table gives the results of chemical analyses of the soils of the different types in Gibson County, expressed in pounds of elements per acre, in 2,000,000 pounds of the surface of an acre, representing the plowed surface of the mineral soils, and a foot or more in the case of Muck.

Chemical composition of Gibson County soils

(Elements in pounds per acre 2,000,000 pounds)

Element	No. 21, Tilsit silt loam	No. 19, Gibson silt loam	No. 22, Haubstadt silt loam	No. 8, Owensville silt loam	No. 5, Princeton fine sand	No. 45, Princeton fine sandy loam	No. 7.1, Princeton silt loam	No. 26, Bainbridge silt loam	No. 3, Elk fine sand	No. 32, Elk fine sandy loam	No. 33, Elk silt loam	No. 11, Elk loam	No. 47, Lintonia silt loam	No. 15, Buckner silt loam
Phosphorus [1]	1,223	1,311	1,311	1,136	700	437	700	612	786	1,050	960	1,400	1,400	1,310
Potassium [1]	1,681	2,522	1,850	3,027	336	1,345	3,195	3,027	840	1,345	1,850	4,036	2,522	7,567
Calcium [1]	3,143	3,143	4,000	5,286	3,000	4,143	4,286	3,286	2,571	5,286	1,857	4,286	5,857	7,714
Magnesium [1]	2,413	2,774	2,533	3,860	965	2,171	3,619	2,654	724	2,413	2,533	2,533	2,774	3,016
Manganese [1]	720	1,008	864	144	432	720	144	576	1,132	576	144	720	576	144
Iron [1]	37,050	32,062	32,062	42,500	25,650	21,375	45,600	30,000	18,525	19,950	25,650	45,600	42,750	52,725
Aluminum [1]	23,400	28,200	26,800	32,600	12,000	11,140	36,200	25,800	13,100	22,900	30,750	41,900	18,600	54,200
Sulphur [1]	401	882	561	962	561	401	481	802	1,282	561	321	802	561	962
Phosphorus [2]	35	35	35	148	79	61	26	35	114	35	210	96	218	114
Potassium [2]	50	50	67	185	151	168	67	67	84	67	101	50	202	67
Nitrogen [3]	2,000	2,000	1,800	2,200	800	1,600	2,000	1,600	1,000	2,000	2,000	2,400	3,000	3,400
Potassium [3]	25,052	27,912	28,585	16,646	11,266	26,735	32,621	26,735	11,266	20,346	24,045	26,563	35,143	27,240

Element	No. 36, Buckner loam	No. 43, Buckner silty clay loam	No. 18, Montgomery silty clay loam	No. 28, Montgomery silt loam	No. 30, Montgomery silt loam, dark phase	No. 2, Lyles fine sandy loam	No. 9, Lyles silt loam	No. 46, Lyles loam	No. 42, Tyler sandy loam	No. 16.1, Tyler clay loam	No. 39, Tyler clay loam, brown phase	No. 24, Robertsville silt loam	No. 14.1, Calhoun silt loam	No. 34, Calhoun clay loam
Phosphorus [1]	1,136	1,835	2,097	1,835	1,485	1,573	1,310	1,223	700	1,310	1,398	1,050	700	874
Potassium [1]	4,372	5,717	2,690	3,027	4,204	1,009	5,885	2,690	2,858	4,708	4,372	2,018	2,018	3,027
Calcium [1]	5,714	11,572	9,714	8,857	7,572	4,286	7,429	13,429	5,429	6,429	6,000	4,572	4,572	5,000
Magnesium [1]	3,136	6,273	4,946	4,946	4,222	1,809	2,413	4,343	2,413	3,740	3,257	3,257	2,171	3,016
Manganese [1]	144	864	288	144	576	288	288	144	288	432	144	144	144	288
Iron [1]	42,750	57,000	37,200	41,325	42,500	18,300	35,600	35,600	25,650	62,700	41,300	28,500	24,200	27,700
Aluminum [1]	45,600	62,700	42,400	34,000	30,200	18,700	27,700	31,400	29,800	37,200	66,400	40,400	25,100	37,500
Sulphur [1]	561	561	160	882	561	1,202	1,363	721	401	401	481	641	481	240
Phosphorus [2]	52	87	350	140	44	96	79	385	148	105	79	61	96	175
Potassium [2]	118	235	168	101	84	135	202	101	101	185	151	84	118	118
Nitrogen [3]	2,800	4,200	2,800	2,600	3,400	2,000	2,200	4,400	2,000	3,400	2,800	1,600	2,200	2,200
Potassium [3]	30,771	30,771	32,957	26,231	23,877	12,274	16,142	27,240	17,487	27,240	27,240	27,576	27,576	25,895

Element	No. 17, Calhoun silty clay loam	No. 25.1, Robinson silt loam	No. 29.1, McGary silt loam	No. 35, Genesee silt loam	No. 12, Genesee fine sandy loam	No. 13, Genesee silty clay loam	No. 38, Genesee silty clay loam, poorly drained phase	No. 20, Holly silt loam	No. 23, Waverly silt loam	No. 41, Sharkey silty clay loam	No. 10 Sharkey clay loam	No. 31, Sharkey clay	No. 37, Sharkey clay, poorly drained phase	No. 4, Muck
Phosphorus [1]	961	961	874	1,310	786	1,748	1,835	1,398	1,049	1,136	1,136	2,097	1,835	2,621
Potassium [1]	3,867	2,354	2,690	3,531	4,036	9,248	5,885	2,354	3,027	2,690	4,540	7,567	5,044	2,690
Calcium [1]	4,143	4,714	2,571	13,715	10,857	10,857	10,143	5,714	3,571	11,857	6,714	12,715	7,714	48,000
Magnesium [1]	3,257	2,654	2,051	7,238	4,343	4,343	4,825	1,448	1,448	3,498	2,413	7,841	5,066	6,031
Manganese [1]	288	144	1,008	144	144	144	432	576	144	288	288	288	288	288
Iron [1]	35,600	31,350	29,800	42,100	31,350	71,250	62,700	35,600	29,100	35,600	31,800	71,250	53,600	10,600
Aluminum [1]	38,100	16,100	10,800	42,200	27,500	71,400	94,000	26,800	33,000	45,600	34,300	89,700	75,100	82,600
Sulphur [1]	321	321	240	561	1,202	802	641	401	641	481	802	882	561	1,683
Phosphorus [2]	262	315	105	262	201	122	262	35	52	419	350	175	262	201
Potassium [2]	286	118	84	135	34	168	252	34	34	118	101	185	168	135
Nitrogen [3]	2,600	2,400	1,400	3,000	1,800	3,600	5,200	1,800	1,600	2,600	1,800	4,400	4,400	24,400
Potassium [3]	31,780	32,116	23,877	32,789	21,859	31,780	31,780	29,426	28,249	27,240	24,381	32,789	35,984	11,266

[1] Soluble in strong hydrochloric acid (sp. gr. 1.115).
[2] Soluble in weak nitric acid (fifth normal).
[3] Total.

Three groups of analyses are given—elements soluble in strong (specific gravity 1.115) hydrochloric acid, elements soluble in weak (fifth-normal) nitric acid, and total plant-food elements.

The total plant-food content is more valuable in indicating the origin of the soil than the fertility. This is particularly true in case of potassium. The quantity of total potassium in a soil is seldom an index of its need of potash. Some Indiana soils have over 30,000 pounds of total potassium per acre in the surface 6 inches, yet they fail to grow corn without potash fertilization, because so little of the potassium is available.

Total nitrogen is generally indicative of the needs for nitrogen, although some soils with low total nitrogen may have a supply of available nitrogen sufficient to grow a few large crops without the addition of nitrogen. Soils having a low total nitrogen content soon wear out, in so far as that element is concerned, unless the supply is replenished by legumes or the use of nitrogenous fertilizers.

The quantity of total phosphorus in ordinary soils is usually about the same as that shown by a determination made with strong acid. For this reason a separate determination of total phosphorus has been omitted. A low supply of total phosphorus usually indicates the need of a soil for phosphate fertilizers, although there are exceptions to this.

The quantity of phosphorus soluble in weak acid is considered by many authorities as a still better indication of the phosphate needs of a soil. The depth of a soil and its composition may modify its need for phosphates. Everything else being equal, the more phosphorus soluble in weak acid a soil contains, the less it is apt to need phosphate fertilizers. Whenever the weak acid soluble phosphorus runs less than 100 pounds per acre phosphates are usually needed.

The percentage of potassium soluble in strong or weak acid is to some extent significant. This determination, however, is not so reliable an indicator as the determination of phosphorus, particularly with soils of high lime content. Sandy soils, level silt loams, and muck are more often in need of potash than clay and rolling or hilly loam soils. Some soils high in lime are in need of potash.

The use of strong or weak acid in the analysis of a soil has sometimes been criticized as having little or no value, yet analyses made with strong or weak acids more often can be correlated with crop production than can analyses made of the total elements of the soil. For this reason both strong and weak acid determinations have been included in these analyses.

It must be admitted, however, that no one method of analysis can definitely indicate the deficiencies of a soil. For this reason these chemical data are not intended to be the sole guide in determining the soil needs. The depth of the soil, the physical and chemical character of the subsoil and surface soil, and the previous treatment and management of the soil are all factors of the greatest importance that should be taken into consideration.

The nitrogen, phosphorus, and potassium contents of a soil are by no means the only chemical indications of high or low fertility. One of the most important factors in soil fertility is the degree of acidity. Soils which are very acid will not produce the highest yields, even though there may be no lack of plant nutrients. Nitro-

gen, phosphorus, and potassium can not be most effective under acid-soil conditions.

The following table shows the percentage of volatile matter, percentage of nitrogen, and the acidity of the various soils found in the county, the acidity being expressed in terms of pounds of limestone needed per acre. Samples were taken from the surface soil (0 to 6 inches), from the subsurface (6 to 18 inches), and from the subsoil (18 to 36 inches). It is important to know the reaction not only of the surface soil but of the lower layers as well.

Volatile matter, and nitrogen and acidity of Gibson County soils

Number	Soil type	Depth	Volatile matter	Nitrogen	Acidity,[1] pounds of limestone
		Inches	*Per cent*	*Per cent*	*Per acre*
21	Tilsit silt loam	0–6	2.89	0.10	140
		6–18	2.40	.03	1.340
		18–36	3.20	.03	5.360
19	Gibson silt loam	0–6	3.14	.10	100
		6–18	3.00	.04	3,080
		18–36	3.18	.03	4,860
22	Haubstadt silt loam	0–6	2.65	.09	260
		6–18	2.86	.04	780
		18–36	3.27	.03	3,180
8	Owensville silt loam	0–6	3.44	.10	140
		6–18	3.12	.05	180
		18–36	2.52	.03	240
5	Princeton fine sand	0–6	1.35	.04	160
		6–18	.47	.02	120
		18–36	.49	.01	120
45	Princeton fine sandy loam	0–6	2.11	.08	100
		6–18	1.42	.04	120
		18–36	2.92	.03	1,000
7.1	Princeton silt loam	0–6	3.70	.10	280
		6–18	3.95	.06	3,000
		18–36	3.09	.03	3,200
26	Bainbridge silt loam	0–6	2.88	.08	260
		6–18	2.76	.05	120
		18–36	3.54	.05	60
3	Elk fine sand	0–6	1.28	.05	320
		6–18	1.09	.01	100
		18–36	.90	.01	200
32	Elk fine sandy loam	0–6	3.35	.10	60
		6–18	2.38	.07	60
		18–36	2.08	.04	100
33	Elk silt loam	0–6	3.82	.10	940
		6–18	2.26	.04	3,700
		18–36	2.54	.02	3,800
11	Elk loam	0–6	4.15	.12	160
		6–18	3.24	.05	4,880
		18–36	3.44	.04	8,700
47	Lintonia silt loam	0–6	4.65	.16	140
		6–18	4.35	.17	100
		18–36	3.20	.09	80
15	Buckner silt loam	0–6	6.30	.16	60
		6–18	5.48	.14	60
		18–36	4.15	.07	180
36	Buckner loam	0–6	4.93	.14	100
		6–18	4.56	.11	200
		18–36	4.30	.05	3,500
43	Buckner silty clay loam	0–6	7.95	.21	80
		6–18	6.05	.16	60
		18–36	5.45	.11	100
18	Montgomery silty clay loam	0–6	5.50	.14	80
		6–18	3.80	.09	60
		18–36	2.84	.05	40
28	Montgomery silt loam	0–6	4.52	.13	80
		6–18	4.05	.11	60
		18–36	3.12	.06	60
30	Montgomery silt loam—dark phase	0–6	5.35	.18	80
		6–18	4.43	.10	80
		18–36	3.90	.05	60
2	Lyles fine sandy loam	0–6	3.15	.10	160
		6–18	2.79	.07	200
		18–36	1.98	.03	120

Volatile matter, and nitrogen and acidity of Gibson County soils—Continued

Number	Soil type	Depth	Volatile matter	Nitrogen	Acidity,[1] pounds of limestone
		Inches	*Per cent*	*Per cent*	*Per acre*
9	Lyles silt loam	0–6	3.84	.11	100
		6–18	3.46	.09	80
		18–36	2.02	.04	80
46	Lyles loam	0–6	6.97	.22	120
		6–18	6,72	.18	100
		18–36	3.55	.07	100
42	Tyler sandy loam	0–6	3.41	.10	100
		6–18	2.62	.07	60
		18–36	2.77	.05	60
16.1	Tyler clay loam	0–6	6.18	.17	240
		6–18	4.87	.11	140
		18–36	5.30	.06	2,600
39	Tyler clay loam, brown phase	0–6	5.84	.14	80
		6–18	4.58	.10	120
		18–36	3.86	.06	4,000
24	Robertsville silt loam	0–6	2.60	.08	100
		6–18	1.86	.03	1,440
		18–36	1.84	.03	2,180
14.1	Calhoun silt loam	0–6	4.16	.11	200
		6–18	3.00	.04	2,400
		18–36	3.80	.03	3,600
34	Calhoun clay loam	0–6	3.78	.11	160
		6–18	2.80	.05	800
		18–36	3.09	.03	400
17	Calhoun silty clay loam	0–6	4.22	.13	340
		6–18	3.21	.07	1,960
		18–36	3.36	.04	2,300
25.1	Robinson silt loam	0–6	3.82	.12	300
		6–18	2.80	.07	220
		18–36	2.82	.05	200
29.1	McGary silt loam	0–6	3.14	.07	300
		6–18	2.75	.04	2,400
		18–36	4.30	.04	A
35	Genesee silt loam	0–6	5.35	.15	A
		6–18	5.39	.17	A
		18–36	4.08	.07	A
12	Genesee fine sandy loam	0–6	3.26	.09	120
		6–18	2.67	.04	140
		18–36	3.81	.03	120
13	Genesee silty clay loam	0–6	6.78	.18	100
		6–18	5.37	.12	80
		18–36	4.20	.06	100
38	Genesee silty clay loam, poory drained phase	0–6	9.62	.26	100
		6–18	5.06	.12	80
		18–36	4.10	.07	20
20	Holly silt loam	0–6	3.22	.09	140
		6–18	2.08	.04	100
		18–36	2.37	.05	120
23	Waverly silt loam	0–6	2.94	.08	280
		6–18	2.10	.03	100
		18–36	2.25	.02	100
41	Sharkey silty clay loam	0–6	5.50	.13	60
		6–18	3.41	.07	40
		18–36	3.28	.05	40
10	Sharkey clay loam	0–6	3.80	.09	100
		6–18	3.83	.07	100
		18–36	3.51	.04	80
31	Sharkey clay	0–6	7.58	.17	80
		6–18	6.75	.14	100
		18–36	5.02	.07	100
37	Sharkey clay, poorly drained phase	0–6	8.02	.22	180
		6–18	5.42	.10	60
		18–36	4.40	.06	60
4	Muck	0–6	30.10	1.22	300
		6–18	20.43	.96	200
		18–36	16.83	.63	200

[1] Hopkins method. Pounds per acre (2,000,000 pounds).

As a general rule, a soil which is only slightly acid or neutral in reaction, and which contains organic matter and nitrogen in its deep subsurface layers, will be more fertile than a shallow acid soil. Given two soils of the same acidity in the surface soil, the soil with the greater acidity in its subsurface layer needs lime much more

than the other soil in which the subsurface layer is less acid than the surface soil. Also, the more organic or volatile matter and nitrogen a soil contains, and the deeper the organic matter penetrates into the subsoil, the less will be the need for lime, as compared with a soil of similar acidity but low in organic matter.

In interpreting the soil map and the analyses, it should be borne in mind that a well-farmed and well-fertilized soil of a type which is naturally low in plant-food elements may produce larger crops than a poorly farmed soil of a type naturally rich in the nutrient elements. Sometimes the character of the subsoil may have more to do with the crop-producing power of a soil than the percentage of plant-food elements in the surface soil. The better types of soils, including those showing large quantities of plant-food elements, will endure exhaustive cropping much longer than the less fertile types.

SOIL MANAGEMENT

For convenience in discussing the management of the several soils of the county, they have been arranged into groups according to certain important characteristics with respect to similar needs. For example, several of the light-colored, upland types, having practically the same content of organic matter and the same fertilizer requirements, may be conveniently discussed as a group, and thus avoid the repetition that would result if each soil were discussed separately. The reader should study the group including the soils in which he is particularly interested.

LIGHT-COLORED UPLAND AND TERRACE SILT LOAMS

The light-colored upland and terrace silt loams include the Gibson, Tilsit, Princeton, Owensville, Vigo, and Lickdale upland silt loams, and the Calhoun silt loam, clay loam, and silty clay loam, and Robertsville, Robinson, Elk, Haubstadt, Bainbridge, Lintonia, and McGary terrace silt loams or second-bottom soils. These light-colored upland and terrace soils are grouped because the practical problems in their management are very similar, regardless of their topographic positions. They are all naturally deficient in phosphorus, nitrogen, and organic matter. In many cases there is also the need of more available potassium. With the exception of the Owensville and some of the Princeton and Lintonia types, these soils are also more or less in need of lime. Most of them should also be tile drained before they can be farmed to the best advantage.

Drainage.—The Owensville, Princeton, Bainbridge, and Lintonia silt loams have fair to good natural drainage, and for the most part they are not in need of tiling. Most of the Gibson, Haubstadt, Elk, and Tilsit soils have good surface drainage; but their subsoils are heavy, and tile underdrainage should be provided as soon as possible in order to lessen surface run-off. The soil conditions should be made as favorable as possible to enable them to trap rain water. Tile drainage will also tend to lessen erosion. The steeper slopes of the Tilsit, Gibson, Princeton, and Owensville soils should be protected from erosion by terracing.

The rest of the soils in this group are all more or less seriously in need of tile underdrainage. Their generally flat topography and

tight subsoils make natural drainage very slow and difficult. Without tile drainage these soils can not be satisfactorily managed. Experience on experiment fields on other soils of similar texture and topography indicates that tile lines laid 30 inches deep and not more than 3 rods apart will give excellent results. Where the land is very flat great care must be exercised in tiling to obtain an even grade and uniform fall. Grade lines should never be established by guess or by any "rule-of-thumb" method. Nothing less accurate than a surveyor's instrument should be used, and all lines should be, first, accurately staked and graded in order to make sure that all the water will flow to the outlet without interruption or slackening of the current. The rate of fall may be increased toward the outlet, but it should never be lessened. Checking of the current may cause the tile to fill with silt. It is an excellent plan, before filling the ditches, to cover the tile with a few inches of straw, weeds, or grass cut from the fields. This will prevent silt from washing into the tile at the joints while the ground is settling, thus insuring proper operation of the tile from the beginning.

Liming.—All of the soils in this group, except the Owensville types and some of the Princeton and Lintonia, are quite generally acid and are in need of liming. Application of some form of lime should be one of the first steps in their improvement. After harmful acidity is properly neutralized the other needs of these soils can be most satisfactorily supplied. In fact, a very acid soil will not respond properly to certain other treatments until after it has been limed. The failure of clover to grow satisfactorily on any of these soils indicates their need of lime. Wherever there is doubt, a soil should be tested for acidity, and some form of lime should be applied whenever the need is indicated.

On the Francisco experiment field, located on Tilsit silt loam, 3 tons of ground limestone per acre, applied in 1915, has since produced crop increases averaging 10.1 bushels of corn, 3.7 bushels of wheat, and 899 pounds of clover-and-timothy hay per acre. (Pl. I, fig. 1.) On manured land a similar application of ground limestone has produced crop increases averaging 4.8 bushels of corn, 5.2 bushels of wheat, and 757 pounds of hay per acre.

As a rule, 2 tons of ground limestone per acre should be the initial application. After that about a ton per acre applied every second round of the rotation will keep the land in a reasonably "sweet" condition. Where alfalfa or sweet clover is to be grown on an acid soil, heavier applications of lime will be needed.

Organic matter and nitrogen.—All of these light-colored soils are naturally low in organic matter and nitrogen. Constant cropping without adequate addition of organic matter has resulted in reduced yields, so that now in many cases conditions are such that satisfactory crops can not be raised until the organic matter and nitrogen supplies are very considerably increased. There is only one practical way to do this, and that is to plow under more organic matter than is removed and to utilize legumes in sufficient quantities to supply the needed nitrogen. To do this satisfactorily, the land must be put into condition to grow clover and other legumes. This means liming whenever the soil is acid, and also the application of soluble

phosphates, because acid soils are usually deficient in available phosphorus. After liming, at least 200 or 300 pounds of acid phosphate should be applied per acre. Wet lands must also be drained before legumes can do well.

In a practical program for building up the organic matter and nitrogen content of the soil, clover or other legumes should appear in the crop rotation every two or three years, as much manure as possible should be made from the produce that is fed, and all produce not fed, such as cornstalks, straw, and cover crops, should be plowed under. It must be remembered that legumes are the only crops that can add any appreciable quantity of nitrogen to the soil, and then only as they are turned under for green manure or as they are fed and the resulting manure applied to the land. The beneficial effect of a legume in the rotation is strikingly shown on the Francisco experiment field located on Tilsit silt loam in this county. This experiment has been in progress only nine years, yet where only the second-growth clover has been plowed under the average yields have been increased by 10.7 bushels of corn and 3.2 bushels of wheat per acre. Aside from these increases on the cereal crops, the clover has produced an annual average of 846 pounds more hay per acre than the timothy on the adjoining plot (Pl. I, fig. 2). Whenever clover-seed crops are harvested, the threshed haulm should be returned to the land and plowed under. Cover crops should be grown whenever possible to supply additional material for plowing under. Planting soy beans or cowpeas between the corn rows after the last cultivation or seeding a mixture of rye and winter vetch early in the fall on cornland that is to be plowed the following spring are good practices to increase both nitrogen and organic matter. It is important to have some cover crop on these soils over winter to take up soluble nitrogen which otherwise would be lost through leaching. In this latitude the ground is not frozen much of the time during the winter, hence the frequent heavy rains cause much leaching.

Crop rotation.—With proper fertilization, tile drainage, and liming when needed, these soils will satisfactorily produce all the ordinary crops adapted to the locality. On account of the organic matter and nitrogen shortage, every system of cropping should include clover or some other legume for soil improvement. Corn, soy beans, wheat, and clover make an excellent rotation on these soils. Oats are not adapted to the climatic conditions and, as a rule, should be omitted. Soy bean yields are not only improved in such a rotation but the crop adds some nitrogen and it also improves the ground for the wheat which follows. If more corn is wanted, the rotation may be lengthened to five years on the better areas by growing two corn crops in succession. Cover crops of rye or, better still, rye and winter vetch should be seeded in the corn in September and plowed under the following spring. When two corn crops are grown in succession, the second one should receive a little more fertilizer. Timothy is not usually a profitable crop; but if wanted, it may be seeded with the clover, and the rotation lengthened another year.

Alfalfa will do well on the Owensville, Lintonia, and Princeton soils, although some areas of Princeton must first be limed. Sweet clover can also be grown wherever the soil is well enough supplied

with lime. These soils are also adapted to various special crops, such as tomatoes and sweet corn, where markets are available.

Fertilization.—All of the soils in this group are naturally low in nitrogen and phosphorus. Some of them show fair supplies of available phosphorus but the total supplies in these, as in the others of the group, are not sufficient to warrant any further draft upon them. The needs of crops, therefore, should be provided for from outside sources to the extent that a satisfactory response is obtained. The total quantities of potassium in these soils are large, but the quantities available to crops are comparatively low, and in many cases some potash fertilizer will be profitable, especially where little manure is used.

The problem of supplying nitrogen has been discussed in connection with the suggestions for supplying organic matter. Legumes and manure are the logical and only really practical means of supplying the bulk of the nitrogen needed by crops, and should be largely relied upon for this purpose. A livestock system of farming with plenty of legumes in the crop rotation, therefore, is best for these soils. However, it will pay in most cases to have some nitrogen in the fertilizer for wheat, regardless of its place in the rotation. Even when wheat follows soy beans or cowpeas it should receive some fertilizer nitrogen, because the nitrogen in the residues of these legumes does not become available quickly enough to be of much help to the wheat in the fall. The material must first decay, and that does not take place to any considerable extent until the following spring.

Phosphorus is the mineral plant-food element most deficient in all of these soils. There is only one way to supply this element and that is by the application of phosphatic fertilizers. It will pay well to supply the entire needs of crops in this way. In rotations of ordinary crops, in which reasonable yields are obtained, it may be counted that 20 pounds of available phosphoric acid per acre per year is required. It will pay well at first to use larger quantities so as to create a small reserve. Enough phosphate to meet the needs for the entire rotation may be applied at one time, or the application may be divided, according to convenience. Where manure is used, it may be counted that each ton supplies 5 pounds of phosphoric acid.

The quantity of potash that should be supplied as fertilizer depends on the general condition of the soil and the quantity of manure used. In building up a run-down soil, some potash should be used until the general condition of the soil is considerably improved. There is plenty of potassium in these soils for all time if it could only be made available. Its availability can be materially increased by good farming, including proper tillage, tile drainage, the growing of deep-rooted legumes, and the incorporation of liberal quantities of organic matter. The better these practices are carried out and the greater the quantity of manure that is used, the less potash will have to be purchased as fertilizer.

As a general rule, from 200 to 300 pounds per acre of a high-analysis complete fertilizer should be applied for wheat. Manure for corn should be plowed under. Two tons of manure per acre may be profitably applied on wheat as a top-dressing during the

winter. Corn should receive acid phosphate or some other available phosphate—applied with the drill when preparing the seed bed—in large enough quantities to meet the needs of the corn crop and, in addition, to add to the phosphorus reserve of the soil, to benefit other crops in the rotation. A portion of the fertilizer for corn, 100 pounds per acre, for example, may be drilled into the row at planting time. Where legumes and manure are utilized, it will seldom pay to use nitrogen in the fertilizer for corn.

LIGHT-COLORED UPLAND AND TERRACE SANDY SOILS

The light-colored upland and terrace sandy soils include the Princeton fine sandy loam and fine sand, the Vigo fine sandy loam, and the Elk loam, fine sandy loam and fine sand. These soils are naturally deficient in organic matter and all three of the fertilizer elements—nitrogen, phosphorus, and potassium. Many areas are in need of lime. Drainage is generally good, and in some cases excessive. Depressed areas of the Vigo fine sandy loam and some of the Elk soils need some artificial drainage.

Liming.—The Vigo fine sandy loam and the Elk loam are the most acid soils in this group, and should be limed. Some of the Elk fine sand also needs lime. One or two tons of ground limestone per acre, or the equivalent in some other form of lime, will usually be sufficient to begin with. After that, a ton of limestone per acre every two or three rounds of the crop rotation will keep the land in good condition.

Some of the Princeton soils are in need of lime, but in less quantities than the Vigo and some of the Elk soils. Wherever clover fails to do well, the soil should be tested for acidity; and lime added according to the needs as indicated.

Organic matter and nitrogen.—The chemical analyses of these sandy soils show them to be very low in both organic matter and nitrogen. Some special provision, therefore, must be made for increasing both of these constituents before their productiveness can be materially increased. As much manure as possible should be made and plowed under along with all unused crop materials. Special green-manure crops and cover crops should be planted whenever possible, for plowing under—including such crops as soy beans, cowpeas, rye, and winter vetch. What has been said under this head in discussing the needs of the light-colored silt loam soils applies equally well here, and the practices recommended for those soils should be followed on these sandy soils. In fact, the very sandy soils require larger additions of both organic matter and nitrates than the heavier soils, because they use up these materials at a faster rate.

Crop rotations.—These soils are especially adapted to the growing of such crops as melons, sweet potatoes, early tomatoes, and early potatoes. They are too droughty for corn, oats, and clover. They will raise fair crops of wheat and rye if organic matter and fertilizer are supplied. They are also good for cowpeas, alfalfa, and sweet clover.

Where melons, tomatoes, or other truck crops are grown, they should be followed by rye or mixed rye and winter vetch, for green manure. Such crops, which should be plowed under the following spring, not only conserve nitrogen, but they also increase the sup-

ply of organic matter in the soil. Cowpeas and wheat or rye are the most satisfactory crops to grow in rotation with the specialized or truck crops. When corn is to be grown, it should be preceded first by a rye or rye-and-vetch cover crop, to be plowed under, and then by cowpeas or soy beans. The latter crops may be readily followed by wheat or rye for grain or by a rye-and-vetch cover crop for plowing under.

No matter what the cropping system may be, these soils should never be left without a winter cover crop. Winter rye and vetch are the most satisfactory crops for this purpose.

Fertilization.—All of the soils in this group are naturally deficient in all of the principal plant-food constituents. Stable manure should be applied as liberally as possible, both for its fertilizer constituents and for the organic matter it supplies. Manure, however, is seldom available in sufficient quantities, so that commercial fertilizer must be resorted to. Early potatoes and tomatoes will respond profitably to heavy applications of high-analysis, complete fertilizers. Five hundred pounds or more per acre of a 2-12-6 analysis should be applied for these and other truck crops. For wheat, a 300-pound application of such a fertilizer is advisable. Where manure is not used, the fertilizer for truck crops should contain more potash, especially when they are grown on the more sandy soils.

Where alfalfa or sweet clover are to be grown, the land must first be sufficiently limed and then 500 pounds per acre of an 0-12-6 or 0-12-12 fertilizer, or the equivalent, should be applied at seeding time. Continuous stands of alfalfa should receive a top-dressing of several hundred pounds per acre of such fertilizer every two years.

DARK-COLORED TERRACE SOILS

Dark-colored terrace soils include the Buckner, Montgomery, Lyles, and Tyler soils. Most of them are fairly well supplied with organic matter and nitrogen. With the inclusion of a legume in the crop rotation, the plowing under of the crop residues, and the application of some manure, there need be no trouble in maintaining sufficient organic matter and nitrogen in these soils. All the areas of the heavier soils are in need of some tile underdrainage. Liming is not generally needed, though there are spots of Buckner and Tyler soils, or patches included in mapped areas of Buckner and Tyler soils, where the subsurface soil is acid enough to call for some lime, especially for the deep-rooted legumes like alfalfa and sweet clover. Most of these soils are better supplied with phosphorus than the light-colored soils. The Tyler sandy loam seems to be very low in total phosphorus, but the availability of its phosphorus is fairly high. However, it will pay in most cases to use some phosphatic fertilizer.

Drainage.—The Montgomery soils, Tyler clay loam, and the Lyles soils are all more or less in need of tile drainage. With the exception of the Montgomery silt loam and some of the Lyles soils, the elevation of these soils is only a little higher than the bottoms which are regularly overflowed, so that the natural drainage is slow. Lines of tile should be laid about 30 inches deep and from 3 to 5 rods apart, depending on the texture of the soil. The precautions suggested for

tiling the uplands should be equally observed in tiling these dark-colored terrace soils, in order to get satisfactory results.

Liming.—As it has been already stated, most of these soils are not in need of liming. There are some areas, however, where lime will be beneficial, especially for clover and other deep-rooted, lime-loving legumes, such as alfalfa and sweet clover. Whenever there is doubt, acidity tests should be made, and some form of lime should be applied when such tests indicate the need of lime.

Crop rotation.—These soils are adapted to all the ordinary crops of the locality. Corn, wheat, and clover, or corn, soy beans, wheat, and clover are the rotations most generally practiced. On the stronger soils, the 4-year rotations just mentioned may be satisfactorily lengthened to a 5-year rotation, by growing two crops of corn in succession. Cowpeas may also be grown on these soils; and when properly drained, and limed where necessary, they may be used for alfalfa or sweet clover. Sudan grass will also do well, and may be satisfactorily used as an emergency hay crop. Much of this land is also adapted to various truck crops.

Fertilization.—For the most part, these soils are fairly well supplied with nitrogen; and if legumes are included in the cropping systems and some manure is used, there will be no need for commercial nitrogen fertilizer, except for wheat and truck crops.

In some cases the soil contains a fair supply of available phosphorus. In most of the soils, however, the total quantity of this element is generally small and can not be depended upon to continue to meet the needs of maximum crops. Considerable quantities of phosphate, therefore, should be applied somewhere in each rotation. Apparently the Buckner silty clay loam and Lyles silt loam are the only soils in this group that are fairly well supplied with available potassium. The others should receive some potash fertilizer, unless manure is used.

As a rule, wheat or rye should receive from 200 to 300 pounds per acre of a 2–12–4 or a 2–12–6 fertilizer. In addition to this, corn should receive 100 pounds per acre of acid phosphate or a 0–12–6 fertilizer, applied in the drill row. For alfalfa, from 300 to 500 pounds per acre of a 0–12–6 fertilizer should be applied. Truck crops should receive the same fertilizer as is recommended for wheat, except in considerably larger applications.

LIGHT-COLORED BOTTOM LANDS

In this group are included the Waverly silt loam and the Holly silt loam. The Waverly soil is naturally wet and heavy, quite generally acid, and deficient in organic matter, nitrogen, phosphorus, and available potassium. The Holly soil is more friable and drains more readily, but it is also more or less acid, deficient in organic matter, nitrogen, phosphorus, and available potassium. In the improvement of these soils, therefore, attention must be given to drainage, liming, to the incorporation of organic matter, the growth of legumes, and to the use of considerable quantities of fertilizer.

Drainage.—The Waverly soil and most of the Holly silt loam should be provided with tile drainage whenever suitable outlets can be provided. Lines of tile should be laid about 30 inches deep and from 2½ to 3 rods apart. In the Waverly silt loam the tight sub-

soil makes a closer spacing of tile lines more desirable. The precautions suggested in discussing the drainage of the heavy upland soils should be carefully observed in tiling this land, in order to get satisfactory results.

Liming.—The Waverly silt loam is very generally acid and is in need of liming. One of the first steps in its improvement should be the application of 2 or 3 tons per acre of ground limestone, or its equivalent in some other form of lime. Subsequent applications may consist of 1 or 2 tons of limestone per acre applied every five or six years. The Holly silt loam is not so much in need of lime as the Waverly silt loam, but most of it is sufficiently acid to need some lime.

Organic matter and nitrogen.—What has been said about supplying organic matter and nitrogen to the light-colored upland and terrace soils applies equally well to the Waverly and Holly silt loams. They are decidedly lacking in both of these constituents; and in order to improve them in this respect, more organic matter than is removed by cropping must be returned to the soil, either as green manure or in the form of stable or yard manure. Legumes must also be grown, to enrich the soil in nitrogen.

Where the land is periodically flooded, clover and other deep-rooted legumes can not be depended upon, but, instead, certain shallow-rooted legumes, like soy beans, cowpeas, and sometimes alsike clover, can be satisfactorily grown. These legumes should be used largely for gathering nitrogen from the air, which they will do when properly inoculated. Here again, it must be remembered that only the top growth, either in the form of green manure or barnyard manure, will really increase the nitrogen content of the soil. Cover crops, such as cowpeas, soy beans, and rye, should be used to the fullest extent. Cornstalks should never be burned, but should be cut up with a disk harrow and plowed under.

Crop rotation.—Where overflowing can not be prevented, the grains grown must be spring-seeded crops; and the grass and clover of varieties that will not be seriously injured by ordinary floods. Ordinarily, corn, soy beans, cowpeas, and in some cases oats or wheat, and timothy and alsike clover, mixed, are the crops that can be satisfactorily grown. With proper fertilization, two crops of corn may often be grown in succession, or two crops may be grown in a rotation—the second corn crop following soy beans or cowpeas. Timothy and alsike, mixed, will do well on this land after it is limed, and fields so seeded may be allowed to remain in grass for two or three years. For late seeding in emergencies, early varieties of soy beans and Sudan grass for either hay or seed may be found useful.

Fertilization.—After the land is limed, most of the nitrogen required can be provided for through the growth of legumes. Cowpeas and soy beans will do fairly well on acid soils, but liming will aid the development of the nitrogen-gathering bacteria. The frequent growth of legumes on these soils is very important, because they are naturally very poor in nitrogen. Nitrogen fertilizers can not be profitably used to any considerable extent on the ordinary cereal crops, being too expensive for these low-priced crops. Legumes should therefore be depended upon for most of the nitrogen

required by corn and small grains. Manure, of course, should be used whenever it is available.

Another important deficiency of these soils is phosphorus. Soluble phosphate fertilizer should be used in quantities sufficient to meet the needs of maximum crops.

The total quantity of potassium in these soils is large; but since its availability is very low, more or less potash fertilizer should be used. The rate of application depends on the extent to which manure and crop residues are utilized.

As a general rule, if wheat or oats are grown, these crops should receive 200 pounds per acre of a 2–12–4 or a 2–12–6 fertilizer. Corn should receive from 200 to 300 pounds per acre of 16 per cent acid phosphate, or its equivalent, broadcast and harrowed in before planting, and 100 pounds of a 0–12–6 or a 2–12–6 fertilizer, applied in the drill row or hill at planting time. Where small applications of manure are used, the fertilizer broadcast for corn should contain some potash. Soy beans and cowpeas may also require direct applications of some phosphate and potash, unless sufficient quantities of these fertilizers are applied elsewhere in the rotation to provide a surplus of phosphate and potassium to meet the needs of these two legumes. Timothy meadow may be materially helped by broadcasting 100 pounds of nitrate of soda per acre after growth is well under way, in April.

THE DARKER-COLORED BOTTOM LANDS

The darker-colored bottom lands include the soils of the Genesee, Huntington, and Sharkey series, which vary from grayish brown to dark brown or dark gray in color, according to content of organic matter.

The greatest difficulty in the management of these soils is to provide adequate drainage and to prevent damage from flooding. The heavier soils should be tiled wherever suitable outlets can be obtained. For the most part these soils are well enough supplied with lime for all ordinary crops.

All of this land is well adapted to corn; but wherever the drainage is satisfactory, some wheat and clover should be included in the rotation. Soy beans or cowpeas and Sudan grass may often be used to advantage, particularly in providing some variation from constant cropping with corn, when small grains can not be satisfactorily grown.

Most of these soils are fairly well supplied with organic matter; and with reasonable care in their management, the nitrogen supplies may be satisfactorily maintained. Where the organic matter and nitrogen supplies are low, cover crops for plowing under may be seeded in the corn. All crop residues should be plowed under.

Much of this land receives rich sediments from the periodic overflows, and hence little fertilizer is needed. The poorer areas, however, will respond to applications of soluble phosphates, and in some cases the additional use of potash may also pay.

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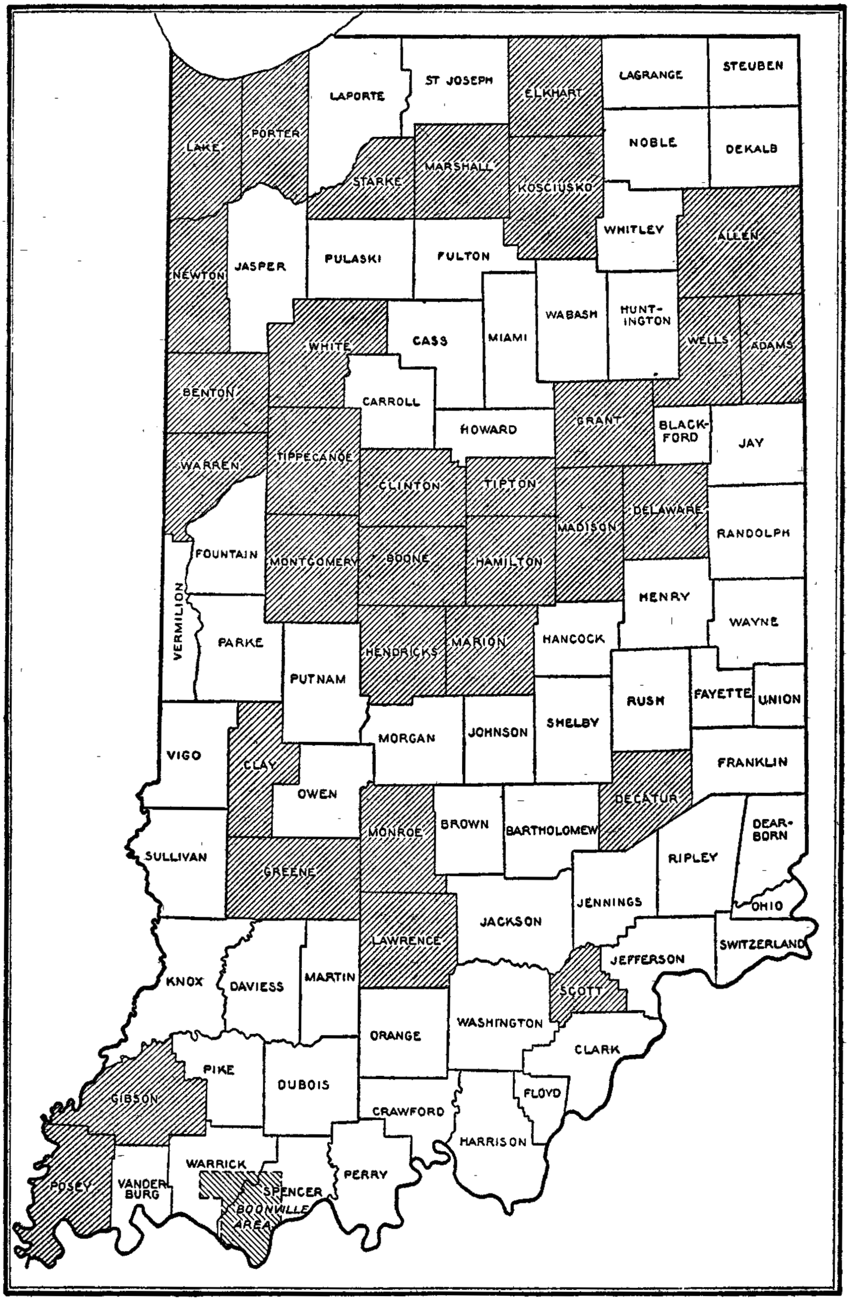

Areas surveyed in Indiana, shown by shading

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BUREAU OF SOILS
IN COOPERATION WITH THE
PURDUE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION

SOIL MAP

INDIANA
GIBSON COUNTY SHEET

Soils surveyed by T. M. Bushnell of the Purdue University Agricultural Experiment Station, in charge, and W. E. Tharp of the U. S. Department of Agriculture.

BASE MAP FROM
U. S. GEOLOGICAL SURVEY SHEETS

Field Operations
Bureau of Soils
1922